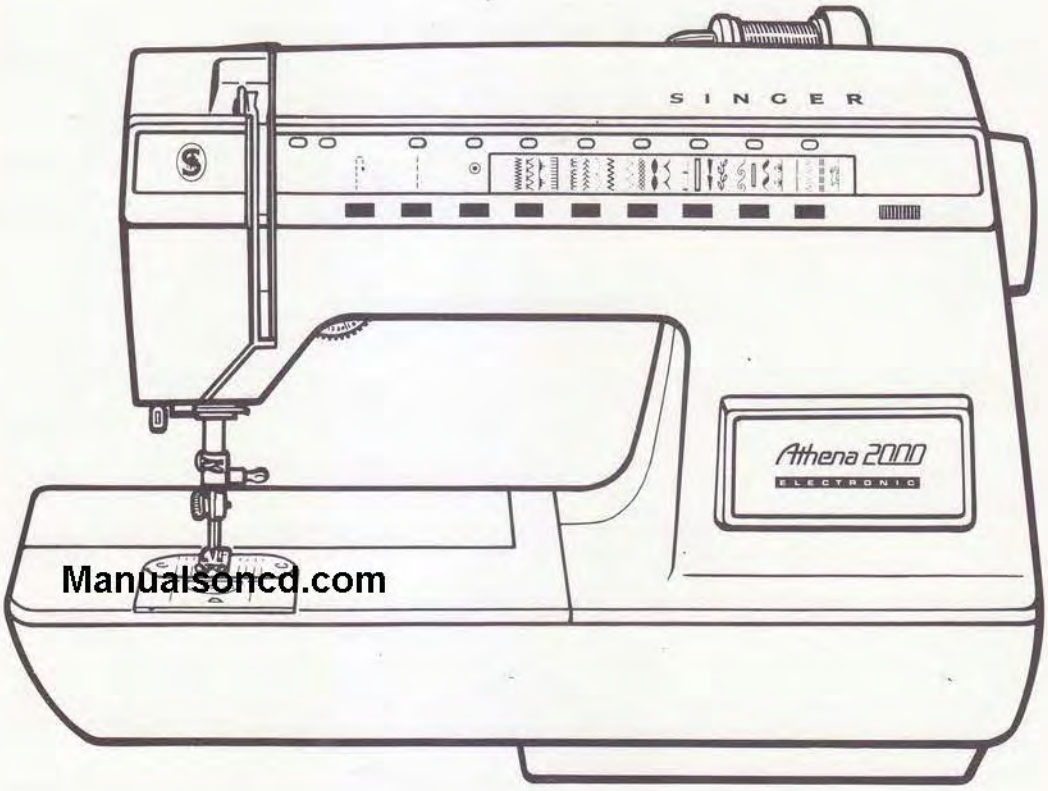
Service Manual

for the

Athena*

sewing machine model 2000

by SINGER



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SECTION 1
GENERAL INFORMATION

SCOPE

This service manual describes all of the servicing procedures, including all mechanical and electronic adjustments, electronic troubleshooting and parts removals and replacements for the 2000A machine.

With the introduction of new concepts in sewing machines by the inclusion of electronic systems, service personnel must also become aware of new concepts in procedures. Careless probing or trial and error methods may easily cause damage to the electronic systems. There must be a thorough understanding of test equipment before attempting any electronic testing or adjustments. Sequential testing must be followed as outlined in the Sequential Checklist and Interlocking Adjustments.

METERS

The Volt-Ohm Milliammeter (VOM) is designed to measure the characteristics of electrical and electronic circuits in a fashion similar to the way gauges are used to measure characteristics of mechanical mechanisms. The VOM is a required tool for the servicing of the 2000A machine. Proper testing and adjustments CANNOT BE MADE without this meter.

Although there are many good meters available, only those with the required degree of accuracy are acceptable. Most digital meters are acceptable. However, any meter fulfilling the following specifications can be used.

Ranges

DC Millivolts
- 0-250 MV minimum
- Sensitivity: 20,000 ohms per volt minimum

DC Volts
- 0-1-2.5-10-50
- Sensitivity: 20,000 ohms per volt minimum

OHMS

RX1	0-2,000
RX100	0-200,000
RX10,000	0-20 megohms

AC Volts
- 0-2.5-10-50-250
- Sensitivity: 5000 ohms per volt

DC Milliamperes
- 0-1-10
- 0-100
- 0-500

DC Amperes
- 0-10

Accuracy

DC Voltage
- All ranges — 2% or less of full scale

Resistance Ranges

		Analog	Digital
RX1	0-2,000 ohms	2.5° of arc	1.0%
RX100	0-200,000 ohms	2° of arc	1.0%
RX1000	0-20 megohms	2° of arc	1.0%

AC Voltages
- All ranges — 3% or less of full scale

DC Amperes
- All ranges — 2% or less of full scale

DESCRIPTION OF MACHINE

Machine Serial Number

The serial number of the machine is located on the underside of the bed casting, at the head-end of the machine, and is visible through an opening in the bottom cover.

The serial numbering system uses a single letter prefix to identify the production line. The first numeral indicates the year built. The next three numerals indicate the calendar day of the year, and the last three numerals indicate the number of the machine built on the production line that day.

Example: S5331053
S—Line that produced the machine
5—Built in 1975
331—331st day of the year (i..e. Nov 27th).
053—53rd machine built on line S on the 331st day.

This numbering system provides a quick means of identifying the age of a machine and keeping up to date with production changes and improvements. Since it is possible to have as many identical serial numbers as there are production lines, the prefix letter is most important. THE PREFIX LETTER IS THE ONLY MEANS OF DISTINGUISHING BETWEEN TWO SERIAL NUMBERS WITH IDENTICAL NUMERALS.

Underwriters Laboratory Listing

The electrical system on the 2000 machine is UL approved. The UL stamp is located on the bottom cover near the machine connector.

Construction of Machine

Construction consists of a number of modules and assemblies mounted on the arm and bed casting. Each of these is briefly described in the following paragraphs and their locations illustrated.

The machine contains the following mechanical systems.
HEAD-END ASSEMBLY AND HOOK - Illustration A. The head-end assembly includes the needle bar and needle bar vibrating bracket, basting stitch latch, quick needle release lever, presser foot and pressure regulating dial and mechanism, and buttonhole tripping lever. The centaur hook includes the front drop-in bobbin and bobbin winding mechanism.

TENSION MODULE - Illustration B. The tension module has an adjustable dial located underneath the arm. A tension release lever underneath the module is operated by the presser foot lever when the presser foot is raised.

ALPHA FEED SYSTEM AND HOOK DRIVE - Illustration C. The Alpha feed shaft is driven by the hook drive shaft through gears. Feed dog motion is controlled by eccentrics on the Alpha feed shaft. The feed regulator controls the amount and direction of the feed. The hook shaft is driven by the arm shaft through the timing belt.

ELECTRICAL SYSTEM - Illustration D. The motor drives the arm shaft through a belt. Two ranges of speed are selected by a switch on the arm. Motor speed in each range is varied by a solid state (SCR) circuit controlled by the foot controller.

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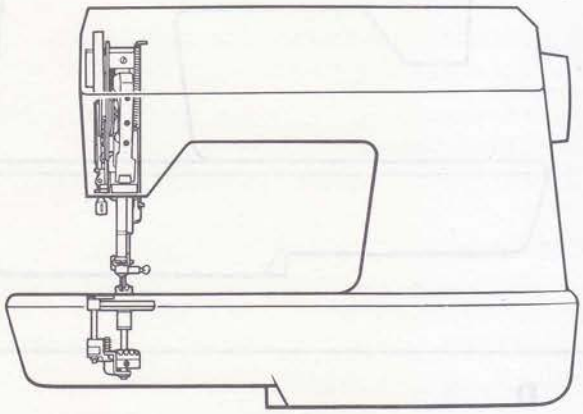
A



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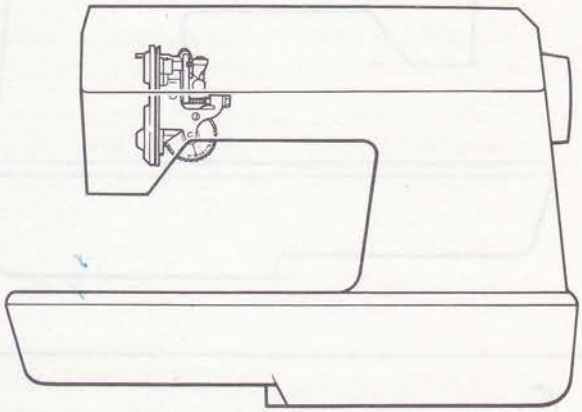

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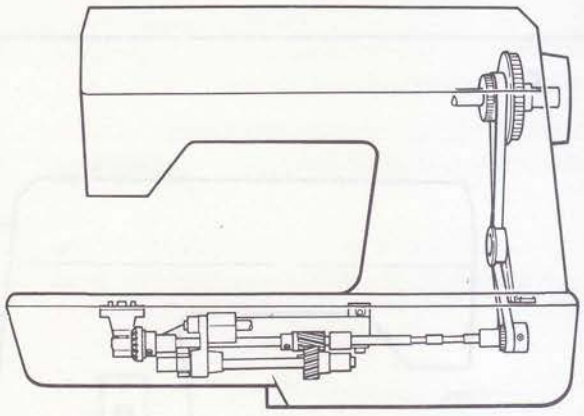

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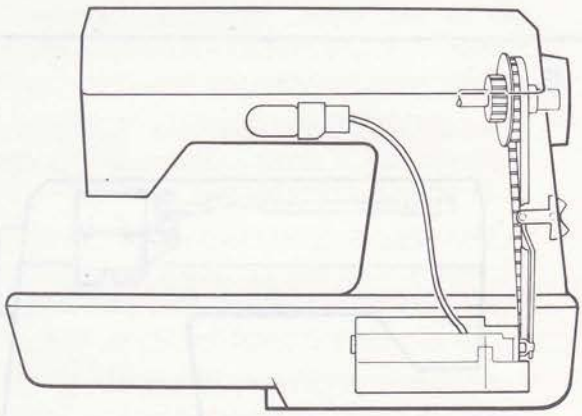

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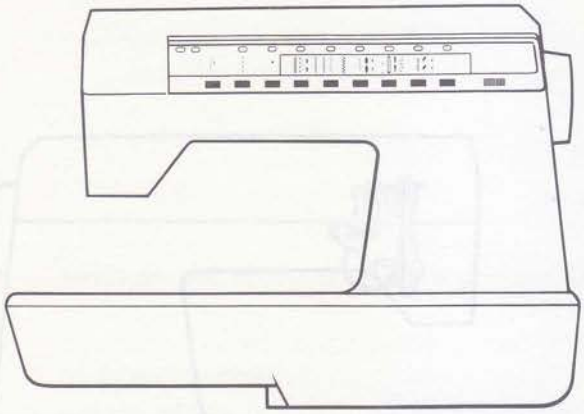

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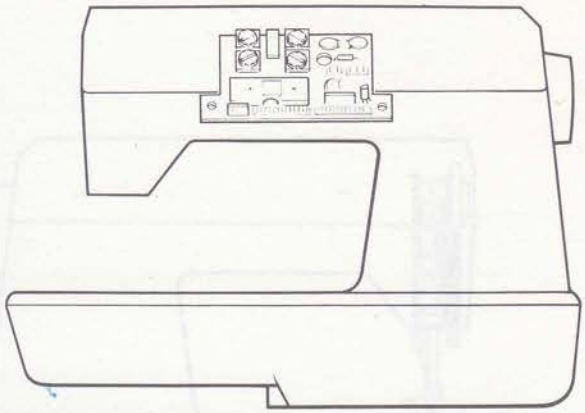

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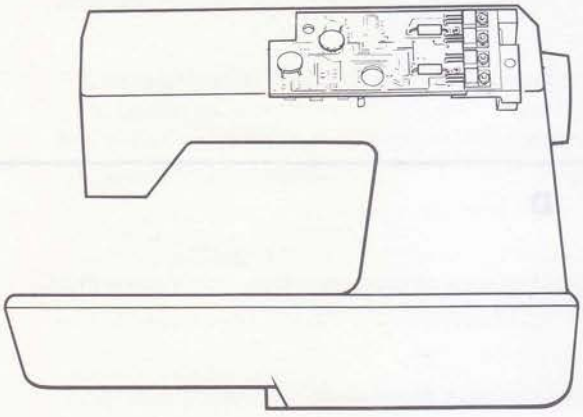

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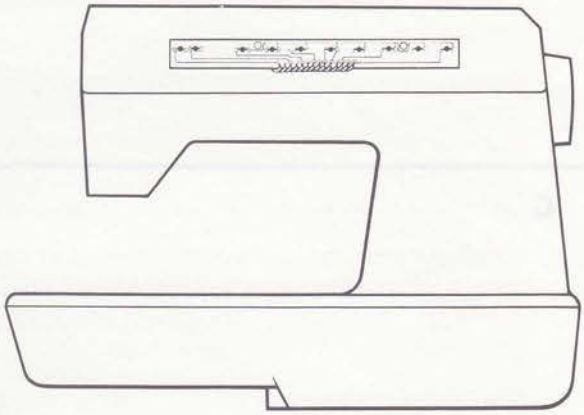

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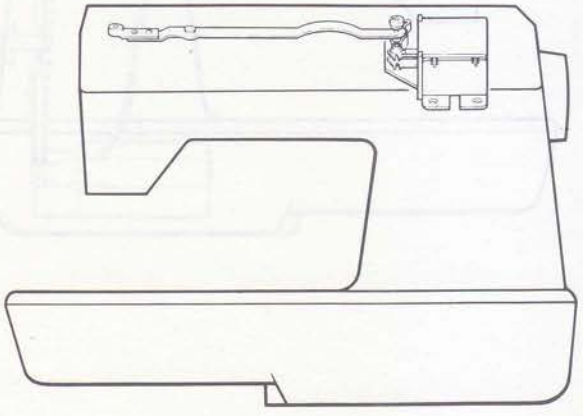

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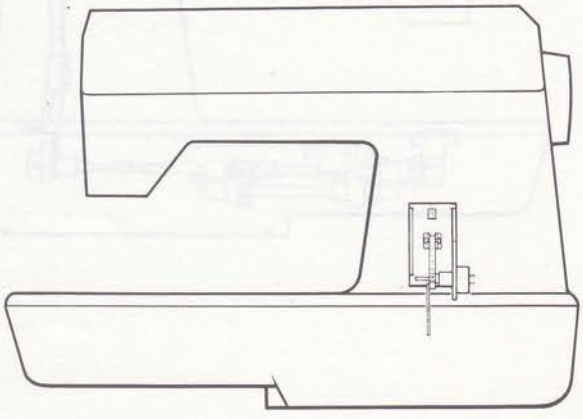

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The electronic and electro/mechanical systems and their sequence of operation consist of the following:

Operator selects pattern by first moving mode switch. This selects a particular stitch out of a group of four and places the desired stitch in position to be called out of memory. Call up is performed by pushing button under desired pattern which is high lighted in yellow on the Selection Panel. Illustration A.

By means of wiring between the selection panel and Master Control (Digital P.C. Board). Illustration B, the information is passed to the digital control circuitry contained in the L.S.I. (Large Scale Integrated) chip. The selection signal is passed through a series of logic gates within the L.S.I. and is encoded into a binary number. This number in combination with the binary information already supplied by the mode switch locks the selection into a latch or holding circuit.

The information then goes into the address memory where the actual location addresses of the pattern data in the main READ-ONLY MEMORY is stored. The R.O.M. is then addressed and, much like selecting a record in a juke box, the stored pattern data is made ready to be fed step-by-step to the linear circuitry Servo Control and Power Circuitry (Servo P.C. Board), Illustration C, after conversion to an analog-type data output.

When the address memory mentioned above initially gets the information, it provides an information output to the LIGHT EMITTING DIODE verification system on the L.E.D. P.C. board (located above the selection panel), Illustration D. The appropriate L.E.D. driver is activated thus lighting the L.E.D. over the pattern selected.

The servo control and power circuitry accepts data in analog (continuous voltage) form from the Master Control (Digital P.C. Board). The signal passes through various conditioning and shaping stages and arrives at the inputs to the bight, Illustration E, and feed, Illustration F, linear motors, which, when proper data is presented, position the needle and feed properly.

From a precision potentiometer (variable resistance) coupled to the linear motor output, a feedback, or error signal, is generated. This signal is routed back into the linear circuitry and appropriate corrections are made so that the actual position of the servos corresponds to the required position as programmed and stored in the memory.

When sewing is started by depressing the foot controller, the position of the arm shaft is fed to the digital circuitry by means of a magnetically operated sensor, Illustration G. At the appropriate time, when the needle is out of the fabric or when the feed dog is down, bight and feed data respectively are extracted from the system.

Programmed into the memory is optimum information with regard to the width and length of the pattern. If an alteration is desired on the programmed stitching, the operator touches the knobs on the Override Controls, (Override P.C. Board), Illustration H, signaling the logic in the L.S.I. to change control of width and length from preprogrammed (automatic) to completely manual. Reset to automatic mode is accomplished by re-pressing the pattern selection button. When the bight and feed overrides are activated, an L.E.D. lights up on the L.E.D. board for each override.

As part of the electronics package, there are miscellaneous systems which either provide inputs, such as the buttonholer switch, Illustration I, and the needle plate switch, Illustration J, (which is part of the straight stitch safety system), and those which accept outputs such as the needle bar lock solenoid, Illustration K, and the straight stitch solenoid, Illustration L, (also part of the straight stitch safety system).

The buttonholer switch works with the one-step buttonhole foot. The buttonhole pattern is chosen by pressing the appropriate button. The machine is started, balance is adjusted to give equal feed (density) in both directions, and the operator can then proceed. Automatic reverse occurs at the bottom of the buttonhole and automatic stop (needle up, zero feed) occurs at buttonhole closure. Second time around or additional buttonholes can be accomplished by re-pressing the single pattern button. Both the buttonhole pattern L.E.D. and single pattern L.E.D. will light as reminders of this repeat procedure.

Needle bar lock in the UP position is used for initial pattern starts, certain patterns (Basting, Maxi-stretch) and machine stops (end single pattern, end buttonhole). Activation is provided directly out of memory.

The straight-stitch safety system involves a solenoid which locks or unlocks the needle bar gate upon command. When the straight-stitch needle plate or chain stitch needle plate is inserted, the needle plate switch is depressed, removing power from the safety solenoid, locking the gate and closing a connection in the servo circuit to center the needle. Any needle plate with a zigzag opening meant for use in the 2000A has a recess cut into it to avoid locking the needle bar by not depressing the switch.

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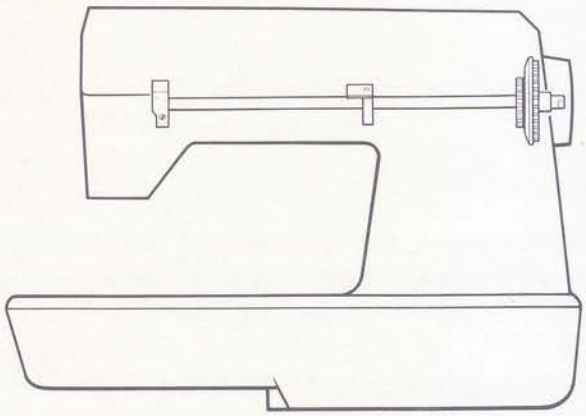

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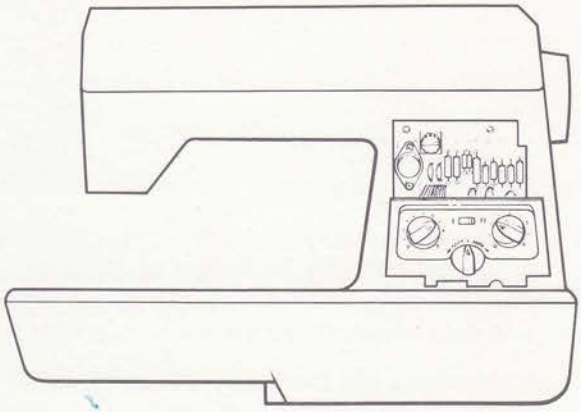

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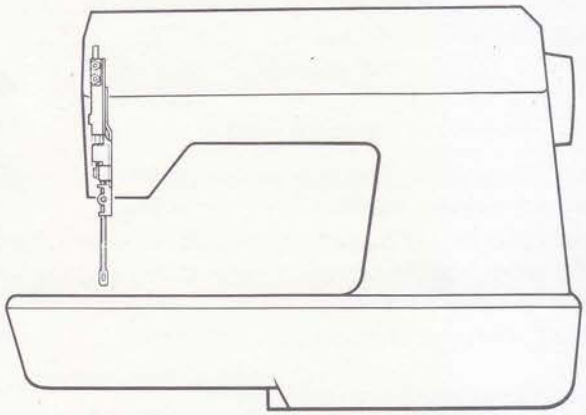

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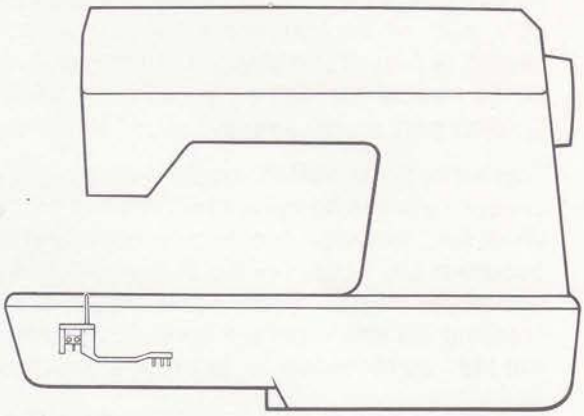

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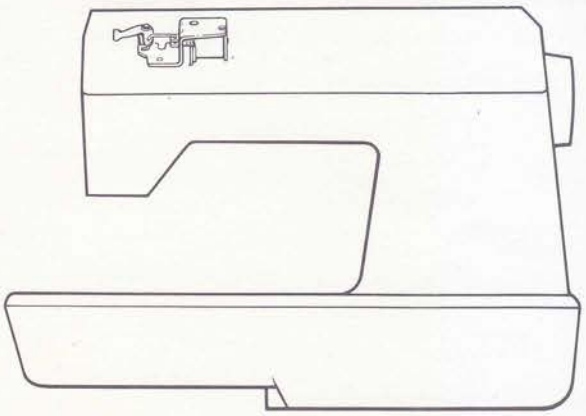

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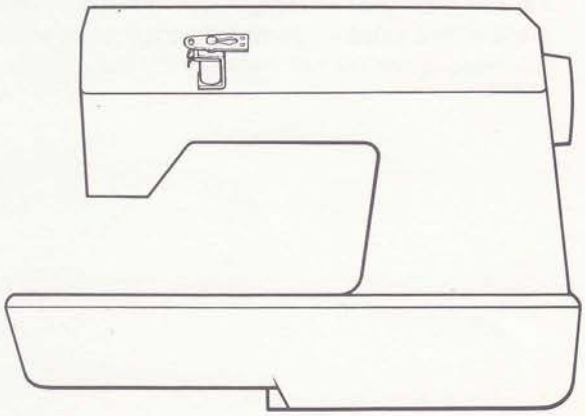

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SECTION 2
ELECTRONIC TEST POINTS AND TROUBLESHOOTING CHART

The following pages provide a description of all the electronic test points available for service and, also, a sequential order of troubleshooting in case of electronic failure.

Do not attempt, under any conditions, to take voltage readings from those test points indicated "Not for Service." These test points are used only with highly specialized test equipment in tightly controlled laboratory environments. Any attempt to probe these points with field meters may cause damage to the associated circuitry. It is important to note that when attaching probes to the service test points, the power must be off and the connection verified. If an accidental touching of a test point not designated for service occurs with the power on, severe and costly damage may result.

Never attempt to take voltage readings with anything other than approved meters, as outlined in Section 1, General Information.

When troubleshooting an electronic failure, it is essential that the sequential order of troubleshooting be followed. Failure to do so may result in the replacement of an incorrect electronic assembly and produce further costly failures.

ATHENA 2000 - ELECTRONICS TEST POINTS - OVERRIDE P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP-1	GROUND OR COMMON	USE FOR ALL TEST POINT MEASUREMENTS FOR ALL PRINTED CIRCUIT BOARDS. CONNECT BLACK METER LEAD HERE.	0 VOLTS	
TP-2	POSITIVE D.C. POWER VOLTAGE - UNREGULATED SUPPLY	NONE - OUTPUT WILL VARY WITH LINE VOLTAGE.	+ 15 VDC	+12VDC TO +18VDC
TP-3	POSITIVE D.C. CONTROL VOLTAGE. REGULATED SUPPLY	NONE - FACTORY PRESET AND SEALED. REQUIRES DIGITAL METER TO SET TO REQUIRED ACCURACY. WHEN USING ANALOG METER, READING TO BE TAKEN FOR VERIFICATION ONLY.	+ 7.5 VDC	+ 7.49 VDC TO + 7.51 VDC (DIGITAL METER) + 7.3 VDC TO + 7.7 VDC (ANALOG METER)
TP-4	NEGATIVE D.C. CONTROL VOLTAGE. REGULATED SUPPLY.	SAME COMMENTS AS FOR TP-3 DEPENDS UPON SETTING OF POSITIVE CONTROL VOLTAGE.	−7.50 VDC	−7.49 VDC TO −7.51 VDC (DIGITAL METER) −7.3 VDC TO −7.7 VDC (ANALOG METER)
TP-5	NEGATIVE D.C. POWER VOLTAGE-UNREGULATED SUPPLY.	NONE - OUTPUT WILL VARY WITH LINE VOLTAGE.	−15 VDC	−12VDC TO −18VDC
TP-6	GROUND OR COMMON	USE TP-1	0 VOLTS	
TP-7	STITCH LENGTH POTENTIOMETER MOVABLE ARM.	PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION. TURN STITCH LENGTH DIAL TO GET OUTPUTS. DEPENDS UPON MOTOR POSITION FOR POLARITY.	0 VOLTS DIAL FULL COUNTERCLOCKWISE ±2.5VDC DIAL FULL CLOCKWISE	±2.3 VDC TO ±2.7 VDC
TP-8	BALANCE CONTROL ACTIVATION	PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT TO OBTAIN FORWARD AND REVERSE FEED POSITIONS.	− 7.5VDC FORWARD FEED + 6.6 VDC REVERSE FEED	− 7.3VDC TO − 7.7 VDC + 6.4VDC TO + 6.8 VDC

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ATHENA 2000 - ELECTRONICS TEST POINTS - OVERRIDE P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP-9	MANUAL BIGHT CONTROL ACTIVATION	PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION.	−7.5VDC OVERRIDE OFF +4.4VDC OVERRIDE ACTIVATED	−7.3VDC TO−7.7VDC +4.2VDC TO +4.6VDC
TP-10	STITCH WIDTH (BIGHT) POTENTIOMETER MOVABLE ARM	PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION. TURN STITCH WIDTH DIAL TO GET OUTPUTS. DEPENDS UPON MOTOR POSITION FOR POLARITY.	0 VOLTS DIAL FULL COUNTERCLOCKWISE ±1.3VDC DIAL. FULL CLOCKWISE	 ±1.25 VDC TO ±1.35 VDC
TP-11	MANUAL STITCH LENGTH CONTROL ACTIVATION	PLACE MACHINE IN RIC RAC PATTERN, ROTATE ARM SHAFT THRU ONE REVOLUTION	−7.5VDC OVERRIDE OFF +4.4VDC OVERRIDE ACTIVATED	−7.3 VDC TO −7.7 VDC + 4.2VDC TO + 4.6VDC
TP-12	BALANCE POTENTIOMETER OUTPUT	PLACE MACHINE IN RIC RAC PATTERN, ROTATE ARM SHAFT TO OBTAIN FORWARD AND REVERSE FEED POSITIONS. TURN BALANCE DIAL TO GET OUTPUT IN BOTH FORWARD AND REVERSE FEEDING DIRECTIONS.	0 VOLTS DIAL FULL COUNTERCLOCKWISE FORWARD FEED. 0 VOLTS DIAL FULL CLOCKWISE FORWARD FEED +7.5VDC DIAL FULL COUNTERCLOCKWISE REVERSE FEED −7.5VDC DIAL FULL CLOCKWISE REVERSE FEED	 +7.3VDC TO +7.7VDC −7.3VDC TO−7.7VDC
TP-13	BALANCE POTENTIOMETER MOVABLE ARM	PATTERN SELECTION UNIMPORTANT - ANY ONE WILL SUFFICE. TURN BALANCE DIAL TO GET OUTPUT.	+7.5VDC DIAL FULL COUNTERCLOCKWISE −7.5VDC DIAL FULL CLOCKWISE	+7.3VDC TO +7.7VDC −7.3VDC TO−7.7VDC

ATHENA 2000 - ELECTRONICS TEST POINTS - DIGITAL LOGIC P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP - 1	L.S.I. CLOCK OUTPUT	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 2	ARM SHAFT POSITION INDICATOR OUTPUT	ROTATE ARM SHAFT THROUGH AT LEAST ONE REVOLUTION TO GET OUTPUT. SENSOR MUST CHANGE FROM POSITIVE OUTPUT TO NEGATIVE OUTPUT ONCE PER REVOLUTION.	+6 VDC SENSOR ON −6 VDC SENSOR OFF	+5.8 VDC TO −6.2 VDC −5.8 VDC TO −6.2 VDC
TP - 3	NEEDLE BAR LOCK UP SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 4	FEED COMMAND SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 5	FEED COMMAND SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 6	FEED REFERENCE SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 7	BIGHT COMMAND SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 8	BIGHT OUTPUT	PLACE MACHINE IN STRAIGHT STITCH - SINGLE PATTERN. ROTATE ARM SHAFT THROUGH ONE REVOLUTION. PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THROUGH ONE REVOLUTION. DIRECTION OF FEED DETERMINES POLARITY.	0 VOLTS DC ADJUST "BIGHT ZERO" TRIMPOT TO GET OUTPUT. ±.640 VDC ADJUST "BIGHT SCALE" TRIMPOT TO GET OUTPUT	0 VOLTS DC (DIGITAL METER) −.005 VDC TO +.005 VDC (ANALOG METER) +.640 VDC (DIGITAL METER) ±.620 VDC TO ±.660 VDC (ANALOG METER)

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ATHENA 2000 - ELECTRONICS TEST POINTS - DIGITAL LOGIC P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP - 9	FEED OUTPUT	PLACE MACHINE IN STRAIGHT STITCH. SINGLE PATTERN. ROTATE ARM SHAFT THROUGH SINGLE REVOLUTION.	0 VOLTS D.C. ADJUST "FEED ZERO" TRIMPOT TO GET OUTPUT	0 VOLTS D.C. (DIGITAL METER) −.005 VDC TO +.005 VDC (ANALOG METER)
		PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THROUGH SINGLE REVOLUTION.	±.920 VDC ADJUST "FEED SCALE" TRIMPOT TO GET OUTPUT	±.920 VDC (DIGITAL METER) ±.900 VDC TO ±.940 VDC (ANALOG METER)
TP - 10	BIGHT COMMAND SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 11	BIGHT REFERENCE SIGNAL	NOT FOR SERVICE - DO NOT READ - DAMAGE TO L.S.I. MAY RESULT.		
TP - 12	SAFETY SOLENOID OUTPUT	DEPRESS NEEDLE PLATE SWITCH WITH MACHINE IN RIC RAC. ROTATE ARM SHAFT THROUGH SINGLE REVOLUTION	−15VDC SOLENOID OFF	−12 VDC TO −18 VDC
		RELEASE NEEDLE PLATE SWITCH.	0VDC SOLENOID ON	
TP - 13	NEEDLE LOCK UP SOLENOID OUTPUT	PLACE MACHINE IN STRAIGHT STITCH	+15VDC SOLENOID OFF	+12 VDC TO +18 VDC
		PUSH SINGLE PATTERN	0VDC SOLENOID ON	

ATHENA 2000 - ELECTRONICS TEST POINTS - SERVO P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP-1	GROUND OR COMMON	USE TP-1 ON OVERRIDE BOARD AS COMMON FOR ALL MEASUREMENTS	0 VDC	
TP-2	FEED OUTPUT SIGNAL - (SAME AS TP-9 ON DIGITAL LOGIC BOARD)	PLACE MACHINE IN STRAIGHT STITCH - SINGLE PATTERN. ROTATE ARM SHAFT PATTERN THRU ONE REVOLUTION.	0 VDC	0 VOLTS DC (DIGITAL METER) −.005 VDC TO +.005VDC (ANALOG METER)
		PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION	±.920 VDC	±.920 VDC (DIGITAL METER) ±.900 VDC TO ±.940 VDC (ANALOG METER)
TP-3	FEED POSITION SIGNAL	PLACE MACHINE IN STRAIGHT STITCH - SINGLE PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION.	0 VDC	
		PLACE MACHINE IN RIC RAC. ROTATE ARM SHAFT THRU ONE REVOLUTION. BALANCE CONTROL DIAL MUST BE SET AT NEUTRAL.	±.920 VDC READING INTERACTS WITH THAT AT TP-2 IF TP-2 IS POSITIVE THEN TP-3 IS NEGATIVE AND VICE VERSA. THEY SHOULD BE EQUAL AND OPPOSITE UNDER THE SAME CONDITIONS WITH FEED AT REST.	±.900 VDC TO ±.940VDC
TP-4	FEED POSITION SIGNAL (BUFFERED)	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR		
TP-5	FEED BALANCE SIGNAL (BALANCE INPUT)	PLACE MACHINE IN RIC RAC PATTERN, ROTATE ARMSHAFT TO BRING FEED TO REVERSE FEED MODE. TURN BALANCE CONTROL DIAL TO GET OUTPUT.	+7.5VDC REVERSE FEED BALANCE DIAL FULL COUNTERCLOCKWISE	+7.3VDC TO +7.7VDC
			−7.5VDC REVERSE FEED BALANCE DIAL FULL CLOCKWISE	−7.3VDC TO−7.7VDC

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ATHENA 2000 - ELECTRONICS TEST POINTS - SERVO P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP-6	FEED ERROR SIGNAL	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR.		
TP-7	FEED CORRECTION RATE SIGNAL	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR		
TP-8	FEED POSITION ERROR VOLTAGE	PLACE MACHINE IN HONEYCOMB. ROTATE ARM SHAFT SIX TIMES BY HAND. OBSERVE VARIATION IN VOLTAGE WITH EACH REVOLUTION.	±2.2VDC MAXIMUM	±2.2 VDC MAXIMUM (DIGITAL METER) ±2.4VDC MAXIMUM (ANALOG METER) VALUES IN EXCESS OF ABOVE INDICATE MECHANICAL BINDS IN SYSTEM.
TP-9	GROUND OR COMMON	USE TP-1 ON OVERRIDE BOARD AS COMMON FOR ALL MEASUREMENTS.	0 VOLTS DC	
TP-10	BIGHT OUTPUT SIGNAL (SAME AS TP-8 ON DIGITAL LOGIC BOARD)	PLACE MACHINE IN STRAIGHT STITCH-SINGLE PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION. PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION.	0 VDC ±.640 VDC	0 VOLTS DC (DIGITAL METER) −.005VDC TO +.005VDC (ANALOG METER) ±.640 VDC (DIGITAL METER) ±.620 VDC TO ±.660 VDC (ANALOG METER)
TP-11	BIGHT POSITION SIGNAL	PLACE MACHINE IN STRAIGHT STITCH-SINGLE PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION. PLACE MACHINE IN RIC RAC PATTERN. ROTATE ARM SHAFT THRU ONE REVOLUTION.	0 VDC ±.640 VDC READING INTERACTS WITH THAT AT TP-10 IF TP-10 IS POSITIVE THEN TP-11 IS NEGATIVE AND VICE-VERSA. THEY SHOULD BE EQUAL AND OPPOSITE UNDER THE SAME CONDITIONS WITH BIGHT AT REST.	±.620VDC TO ±.660 VDC

ATHENA 2000 - ELECTRONICS TEST POINTS - SERVO P.C. BOARD

TEST POINT	DESCRIPTION	READING CONDITIONS	EXPECTED OUTPUT	ACCEPTABLE RANGE
TP-12	BIGHT POSITION SIGNAL (BUFFERED)	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR.		
TP-13	BIGHT ERROR SIGNAL	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR.		
TP-14	BIGHT CORRECTION RATE SIGNAL	NOT FOR SERVICE - DO NOT READ. DAMAGE MAY OCCUR.		
TP-15	BIGHT POSITION ERROR VOLTAGE	PLACE MACHINE IN HONEYCOMB. ROTATE ARM SHAFT SIX TIMES BY HAND. OBSERVE VARIATION IN VOLTAGE WITH EACH REVOLUTION.	±1.8VDC MAXIMUM	±1.8VDC MAXIMUM (DIGITAL METER) ±2.0 VDC MAXIMUM (ANALOG METER) VALUES IN EXCESS OF ABOVE INDICATE MECHANICAL BINDS IN SYSTEM.

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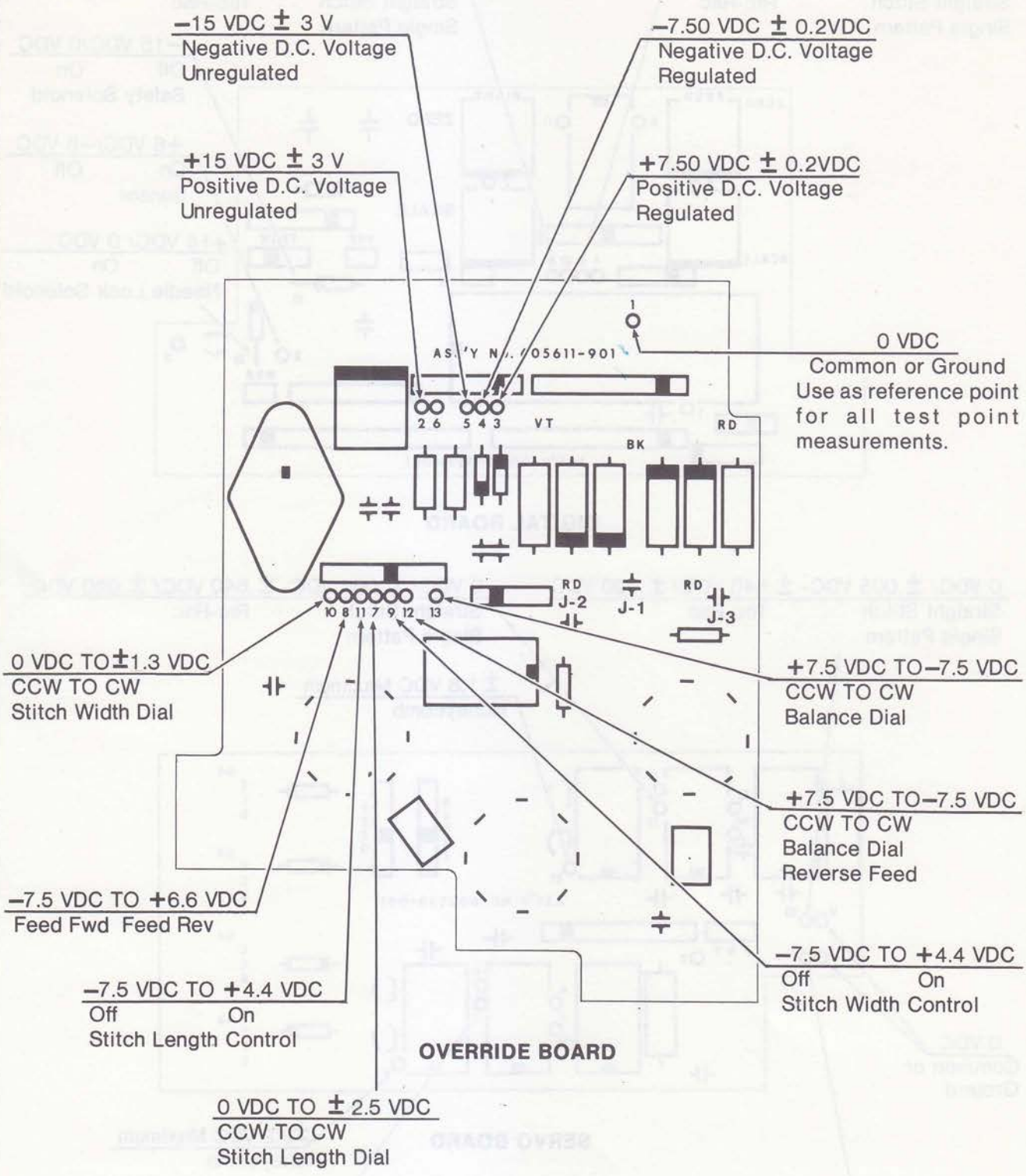
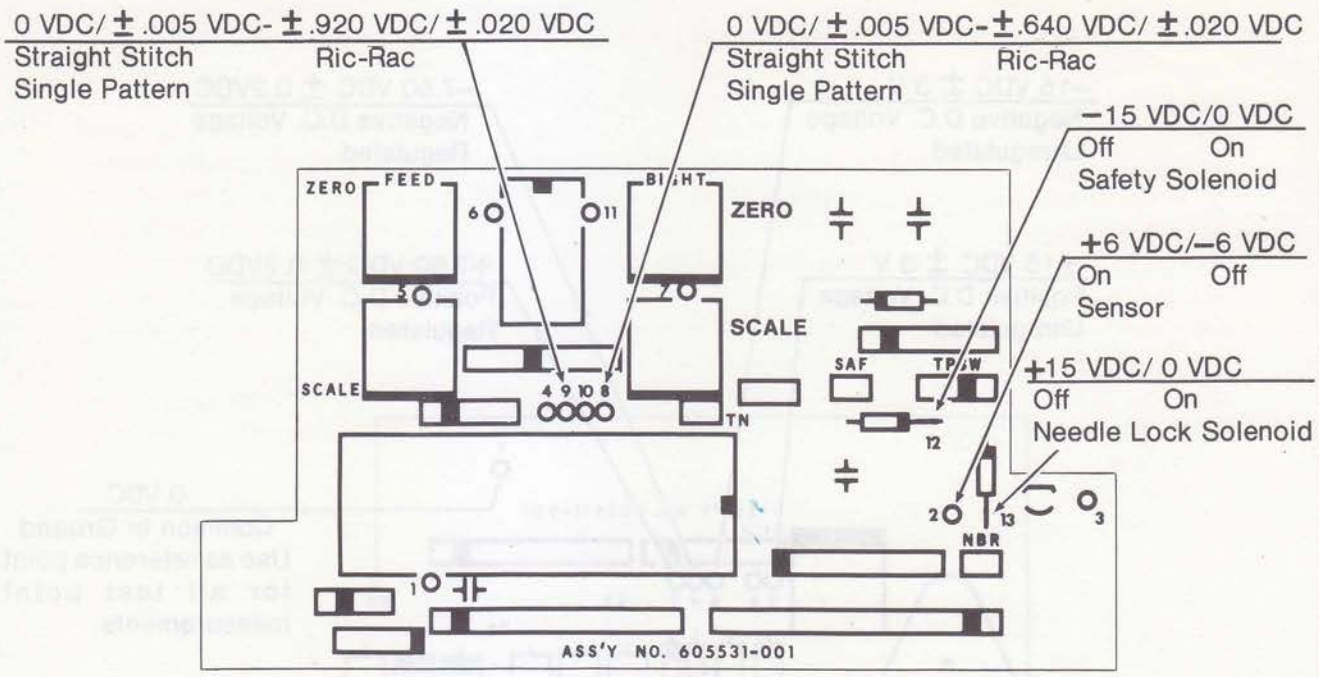


Note: Use Ric-Rac Pattern for Test points 7 thru 13

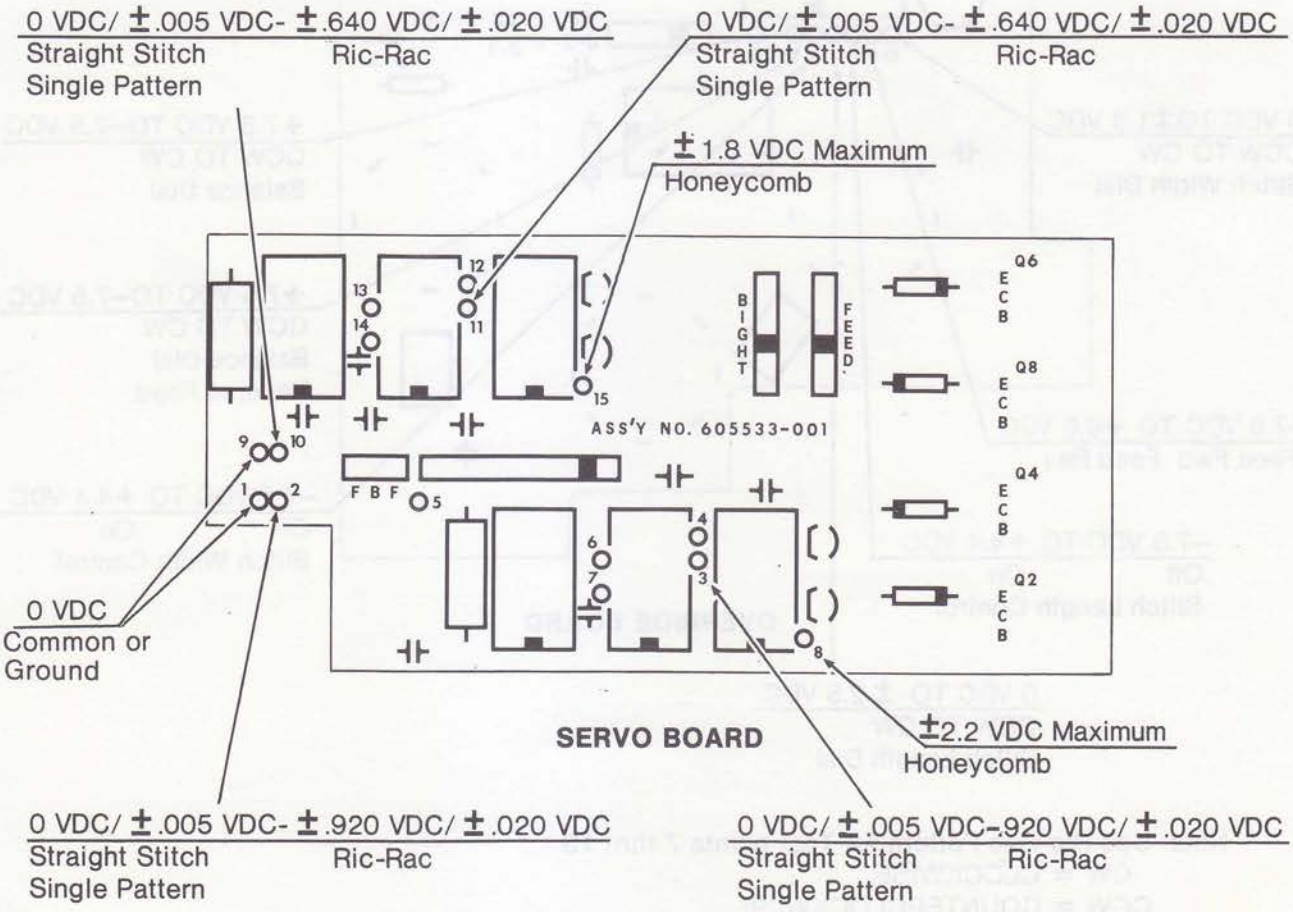
CW = CLOCKWISE

CCW = COUNTERCLOCKWISE

Values for TP-7 through TP-13 are nominal and may vary by ± 10%. Erroneous reading should only be suspect if a problem with the system exists.



DIGITAL BOARD



SERVO BOARD

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2000 ELECTRONIC TROUBLESHOOTING SEQUENCE

The following sequence provides tests and verifications for a complete check of the electronics in the 2000A machine. Careful study of the sequence will show that it is often possible, by reason of elimination, to bypass certain of the tests and proceed to tests further on in the sequence. Whenever this possibility occurs, it will be so indicated. It is seldom necessary to complete the entire sequence. However, if during the testing sequence an electronic assembly is found which has failed, it cannot be assumed that all other assemblies which are checked later in the sequence are good. Keep in mind that by following the sequential order of troubleshooting, time-consuming, hit-and-miss replacements of electronic assemblies and self-defeating effort will be eliminated.

Use of meters other than those specified in Section 1, General Information, may result in incorrect readings. Proper testing and adjustments can only be accomplished by use of the correct meter.

(1) With power off, make sure circuit breaker is set by pushing red reset button located in bottom cover of machine. Turn power on. If circuit breaker remains set, proceed to step (16). If circuit breaker trips or will not stay set, proceed to step (2).

(2) Turn power off. Remove front cover. Disconnect three secondary transformer leads from override board. (Terminal J-1, J-2, J-3) Reset circuit breaker. Proceed to step (3).

(3) Turn power on. If circuit breaker remains set, reconnect secondary leads and proceed to step (16). If circuit breaker trips or will not reset, proceed to step (4).

IMPORTANT NOTE: Steps 4, 6, 10, and 13 require using the V.O.M. to measure resistance of various circuit components. Power must be OFF for these readings or damage to the meter may result.

Also, it is important, before making any measurements, to properly zero the meter by shorting the meter leads together and making the proper adjustment. (Consult the instruction book for the meter in use about the correct procedure.) Since these tests require the use of the lowest resistance scale on the meter, failure to zero the unit properly will result in incorrect readings.

(4) Turn power off. Using a V.O.M., set on the lowest Ohm scale available, take resistance readings to check transformer secondary winding and leads for opens (R = ∞ Ω) or shorts (R = 0 Ω). Reading from transformer center lead (black) to each outside lead (red) should be 0.5 Ω ± 20%. If O.K., proceed to step (6). If not O.K., proceed to step (5).

(5) Reading is ∞ Ω or 0 Ω . Remove override board mounting screws and transformer cover. Check for proper connection of transformer secondary terminals. Recheck readings. If O.K., proceed to step (6). If not O.K., disconnect secondary leads from transformer and take readings directly from transformer terminals. If O.K., replace secondary leads. If not O.K., replace transformer with leads. Recheck readings with new parts in place. If O.K., proceed to step (8).

(6) Remove override board mounting screws and transformer housing cover if not already done. Disconnect transformer primary leads from transformer. Using a V.O.M. set on the lowest Ohm scale available, take resistance readings directly from transformer primary terminals to check transformer primary winding for opens (R= ∞ Ω) or shorts (R = 0 Ω). Reading should be 8 Ω ± 20%. If O.K., proceed to step (8). If not O.K., proceed to step (7).

CAUTION: The following test involves high voltage and can be lethal if handled carelessly. It is imperative that extreme care be exercised for these measurements. Be sure power is off before attaching meter leads.

(7) Reading is ∞ Ω or 0 Ω . Replace transformer. Recheck readings with new part in place. If. O.K., proceed to step (8).

(8) Using a V.O.M., set to measure A.C. voltage, 250V range, clip one meter lead to each transformer primary lead. Keeping leads clear of casting or any other machine components and insulated from one another, turn main power switch on and read meter. Reading should be nominally 120V. Turn power off. If O.K., proceed to step (13). If not O.K., proceed to step (9).

(9) Check for proper connection of power plug to machine. If O.K., remove bottom cover and check for proper connection of motor Mate-N-Lock connector and terminal connections at circuit breaker. If O.K., proceed to step (10).

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(10) Disconnect leads from circuit breaker. Attempt to reset circuit breaker. Using a V.O.M., set on the lowest ohm scale available, take resistance reading at circuit breaker terminals. Reading should be between 0.5 Ω and 3 Ω . If O.K., proceed to step (11). If not O.K., proceed to step (12).

(11) Replace primary transformer leads. Recheck voltage reading as in step (8). If O.K., proceed to step (13).

(12) If breaker will not stay set (R = ∞ Ω) or reading is 0 Ω , replace circuit breaker. Recheck resistance reading as in step (10). If O.K., proceed to step (13).

(13) Disconnect power supply capacitor connector. Discharge by shorting center terminal to each outside terminal. Using a V.O.M., set on the lowest ohm scale, check for defective capacitor by taking resistance reading. Attach black (negative) meter probe to center (common) terminal of capacitor plug. Attach red (positive) meter probe to one of the outside terminals of the capacitor plug. Meter should show some residual resistance initially and gradually change to near infinite (R = ∞ Ω) resistance within a few seconds. Repeat with other outside terminal. If O.K., proceed to step (15). If not O.K., proceed to step (14).

(14) Replace capacitors. Recheck resistance reading. If O.K., proceed to step (15).

(15) Reconnect capacitors, circuit breaker leads, transformer primary and secondary leads to transformer and connect secondary transformer leads to override board. Proceed to step (16).

(16) Remove front cover, top cover and servo board mounting screws if not already done. Disconnect all plugs from the digital and servo boards which originate from the override board. Turn power on. If circuit breaker does not trip, proceed to step (18). If breaker trips, proceed to step (17).

(17) Replace override board.

NOTE: All voltage checks in the following steps are to be made using TP-1 on the override board as common or reference terminal.

Letters in parenthesis following the test point designate on which board the test point is located.

(O) - Override Board

(D) - Digital Board

(S) - Servo Board.

(18) Check unregulated D.C. voltages on the override board at:

TP (0)2 +15VDC/±3VDC
TP (0)5 −15VDC/±3VDC

If O.K., proceed to step (20). If not O.K., proceed to step (19).

(19) Replace override board. Recheck voltage reading as in step (18). Proceed to step (20).

(20) Check regulated D.C. voltages at:

TP (0)3 +7.5VDC/±.2VDC (analog meter)
±.01VDC (digital meter)
TP (0)4 −7.5VDC/±.01VDC (analog meter)
±.01VDC (digital meter)

NOTE: Voltages should be equal within 0.150 V of one another but opposite in polarity. Under no circumstances should they exceed 8.0VDC. If O.K., proceed to step (22). If not O.K., proceed to step (21).

(21) Adjust *only* if *DIGITAL* V.O.M. is available. *Do not* adjust above 8.0VDC under any circumstances or component damage may occur. If digital V.O.M. is not available or if unable to adjust to within specified tolerances, replace override board. Recheck voltage readings as in step (20). Proceed to step (22).

(22) Turn power off. Reconnect all plugs which originate from the override board to the digital board only. Turn power on. Verify D.C. voltages on the override board at TP (0)2, TP (0)3, TP (0)4, and TP (0)5 as in steps (18) and (20). If O.K., proceed to step (24). If not O.K., turn power off immediately and proceed to step (23).

(23) Replace digital board. Recheck voltage readings as in step (22). Proceed to step (24).

(24) Check D.C. voltages on the override board at the following test points under the indicated conditions. The voltages shown are nominal voltages. Actual readings may be up to 10% lower than nominal due to tolerance of associated circuit components, setting of regulated supply voltage, and line voltage. At time of test, it is important that the function involved be operative and resulting performance at the needle be acceptable. These should be the prime criteria for judgement rather than exact voltage readings. Rotate the hand wheel several times after turning the system on to stabilize the system.

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TP (0)7 Ric-Rac Pattern
0VDC S/L Dial CCW
±2.5VDC/±.2VDC S/L Dial CW

TP (0)8 Ric-Rac Pattern
−7.5VDC/±.2 VDC Feed Fwd.
+6.6VDC/±.2VDC Feed Rev.

TP (0)9 Ric-Rac Pattern — Bight Control
−7.5VDC/±.2VDC Override Off
+4.4VDC/±.2VDC Override On

TP (0)10 Ric-Rac Pattern
0VDC S/W Dial CCW
±1.3VDC/±.05VDC S/W Dial CW

TP (0)11 Ric-Rac Pattern — Length Control
−7.5VDC/±.2VDC Override Off
+4.4VDC/±.2VDC Override On

TP (0)12 Ric-Rac Pattern
0VDC Feed Fwd.
Bal. Dial CCW

0VDC Feed Fwd.
Bal. Dial CW

+7.5VDC/±.2VDC Feed Rev.
Bal. Dial CCW

−7.5VDC/±.2VDC Feed Rev.
Bal. Dial CW

TP (0)13 +7.5VDC/±.2VDC Bal. dial CCW
−7.5VDC/±.2VDC Bal. Dial CW

If O.K., proceed to step (26). If not O.K., proceed to step (25).

(25) Replace override board. Recheck voltage readings as in step (24). Proceed to step (26).

(26) Disconnect two-wire lead (white and yellow) originating from the digital board to the servo board. Adjust zero and scale potentiometers for bight and feed, if necessary. Be sure straight stitch needle plate is *not* on machine. Check D.C. voltages on the digital board at:

TP(D)2 +6VDC/±.2VDC Sensor On
−6VDC/±.2VDC Sensor Off

TP(D)8 Straight Stitch — Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.640VDC/±.020VDC

TP(D)9 Straight Stitch — Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.920VDC/±.020VDC

If O.K., proceed to step (28). If not O.K., proceed to step (27).

(27) If voltage at TP (0)2 is incorrect, replace digital board. If TP (0)8 and TP (0)9 are incorrect, check that arrow heads on the dials of the adjustable trimmer potentiometers are facing the front of the machine and are between the 3 and 9 o'clock position. Accurate adjustment may not be possible otherwise. If adjustment is not at all possible, replace digital board. Readjust zero and scale potentiometers as in step (26). If O.K., proceed to step (28).

(28) If problem is a non-functional solenoid-controlled operation which has been checked for proper mechanical adjustment, proceed with this step. If solenoids perform satisfactorily, proceed to step (31).

Check D.C. voltage at appropriate test point to test for correct operation of safety and needle lock solenoid control circuit at:

TP (D)12 Safety Solenoid

−15VDC/±3VDC Off

0VDC/±3VDC On

TP (D)13 Needle Lock Solenoid

+15VDC/±3VDC Off

0VDC/±3VDC On

If O.K., proceed to step (29). If not O.K., proceed to step (30).

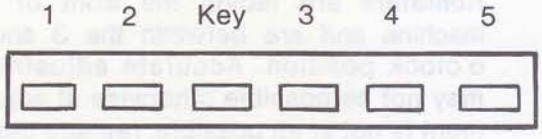
(29) Replace appropriate solenoid, proceed to step (31).

(30) Replace digital board. Readjust zero and scale potentiometers as in step (26). Proceed to step (31).

(31) Turn power off. Disconnect both linear motor plugs from servo board. Reconnect power plug originating from the override board to the servo board. Verify D.C. voltages on the override board at TP (0)2, TP (0)3, TP (0)4, and TP (0)5 as in steps (18) and (20). If O.K., proceed to step (33). If not O.K., turn power off immediately and proceed to step (32).

(32) Replace servo board. Recheck voltage readings as in steps (18) and (20). Proceed to step (33).

(33) Check both linear motors while unplugged from machine and with power off. Take resistance readings with a V.O.M. by probing appropriate non-functioning linear motor plug. Use a machine needle held in alligator clips on the end of the meter leads to probe the plug holes. Make sure the female harness terminals are securely seated in the plastic housing before making measurements.



Probe holes 1 and 2.

Result: 10 Ω ±10%.

Probe holes 4 and 5.

Result: 10,000 Ω ±10%.

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Set center bump on plastic bobbin of linear motor even with front of linear motor housing.

Probe holes 3 and 4.

Result: 5,000 Ω ±10%.

Probe holes 3 and 5.

Result: 5,000 Ω ±10%.

If O.K., proceed to step (35). If not O.K., proceed to step (34).

(34) If any of the readings are outside of specifications or read 0 Ω or ∞ Ω, replace motor. Recheck resistance readings as in step (33). Proceed to step (35).

(35) Reconnect both linear motor plugs to servo board. Make sure two-wire lead (white and yellow) originating from the digital board is connected to the servo board. Check D.C. voltages on the servo board at:

TP (S)2 Straight Stitch - Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.920VDC/±.020VDC

TP (S)3 Straight Stitch-Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.920VDC/±.020VDC

(Interacts with TP (S)2. Should be equal but opposite in polarity under same conditions. However, this reading may be up to 10% lower than reading at TP (S)2 due to tolerances of associated circuit components, setting of regulated supply voltage, and line voltage at time of test.

TP (S)10 Straight Stitch-Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.640VDC/±.020VDC

TP (S)11 Straight Stitch-Single Pattern
0VDC/±.005VDC
Ric-Rac Pattern
±.640VDC/±.020VDC

(Interacts with TP (S)10. Should be equal but opposite in polarity under same conditions. However, this reading may be up to 10% lower than reading at TP (S)10 due to tolerances of associated circuit components, setting of regulated supply voltage, and line voltage at time of test.

If O.K., proceed to step (37). If not O.K., proceed to step (36).

(36) Replace servo board. Recheck voltage readings as in step (35). Proceed to step (37).

(37) Check function of button carrier and L.E.D. board. Selecting any group of patterns, depress all push buttons in that group one at a time. Observe L.E.D. readouts. With the exception of the reverse button (correct function can be observed through use of paper feed test), all other patterns will cause the L.E.D. immediately over the pattern to light.

Touch the override control knobs and observe if the override L.E.D.'s light. If O.K., proceed to step (42). If not O.K., proceed to step (38).

(38) Make paper perforation test of pattern selected which fails to light the L.E.D. If pattern is produced, proceed to step (39). If pattern is not produced, proceed to step (40).

(39) Replace L.E.D. board on button carrier assembly. Recheck as in step (37). If O.K., proceed to step (42). If not O.K., proceed to step (40).

(40) Replace button carrier assembly. Recheck as in step (37). If O.K., proceed to step (42). If not O.K., proceed to step (41).

(41) Replace digital board. Readjust zero and scale potentiometers as in step (26). Proceed to step (42).

(42) Perform bind test as described in Section 3 of the Service Manual.

(43) Perform final sew test as described in Section 4 of the Service Manual.

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SECTION 3
SEQUENTIAL ORDER TO ELIMINATE BINDS IN THE 2000A SYSTEMS

On the following pages is a sequential procedure to detect mechanical binds in the 2000A bight and feed systems by means of electronic testing.

As part of the servo circuitry, a feedback or error voltage is generated to correct the actual position of the linear motors to correspond with the required position as programmed in the L.S.I. It is possible to use this correction voltage reading to determine if excessive binding is present, which the linear motor must overcome. If excessive binding exists, the system will not reach a satisfactory rest point, which may eventualy lead to failures. Because of this situation, certain maximum limits have been established for the residual correction voltages with the system at rest.

It is MANDATORY that any 2000A which has been serviced or in which parts have been replaced be checked ELECTRONICALLY for mechanical binds by measuring the correction voltages for both bight and feed systems.

BIGHT MECHANISM

Machine Setting:

1. Pattern Selection: Honeycomb

Check:

1. Read bight error voltage at TP-15 on the servo P.C. board.
2. Rotate hand wheel by hand through six complete revolutions.
3. Observe voltage readings at the different positions of the linear bight motor.
4. At no time must the voltage exceed ± 1.8VDC MAXIMUM, when using a digital meter; ± 2.0VDC MAXIMUM, using an analog meter.
5. Check for clearance of needle bar high lift adjusting bracket, lifting bracket and plastic guide stop.

NOTE:

If during the adjustment sequence the voltage reading falls below the maximum allowable, the bight mechanism is to be considered free of binds. Proceed to the feed mechanism check.

Adjustment:

1. Test safety stud **A** in needle bar driving arm for interference with safety solenoid lever **B** by pressing lever down and rechecking voltage. If reading is lowered or falls below maximum limit, relocate safety stud on safety solenoid lever.

Early Production:

Loosen linear motor mounting screws and shift motor and driving arm left or right as needed until lever properly seats on stud. Push motor toward front of machine so both bracket holes butt firmly against mounting screws. Tighten motor mounting screws and recheck voltage reading. Reset needle location.

Later Production:

Reset adjustable stud **E** on needle bar driving arm and recheck voltage reading.

2. By means of a feeler gauge, set a clearance of .010" between plastic retaining ring **C** and needle bar driving arm **D** and recheck voltage reading.
3. Remove plastic retaining ring **C** and remove needle bar driving arm **D** from linear motor crank. Recheck voltage reading. MAXIMUM allowable voltage ± 1.0VDC. Motors reading over maximum are to be replaced.
4. With needle bar driving arm **D** disconnected from motor, check for freeness of needle bar vibrator bracket **G** by moving left to right 1/4". If bracket is not free:
   a. Check for interference of needle bar stud with head end plate. Reset if necessary.
   b. Reset vibrator bracket bushing **F** (top) for freeness with no up or down play in the vibrator bracket.
5. Check for proper alignment of needle bar driving arm pin **H** in hole **I** of linear motor crank. Pin should fit freely in hole with hub resting flush on crank. If necessary to obtain proper fit, hold needle bar driving arm at midpoint and flex from the pin end, up or down. Replace plastic retaining ring setting a .010" clearance by means of a feeler gauge between retaining ring and needle bar driving arm. Recheck voltage and recheck needle location.

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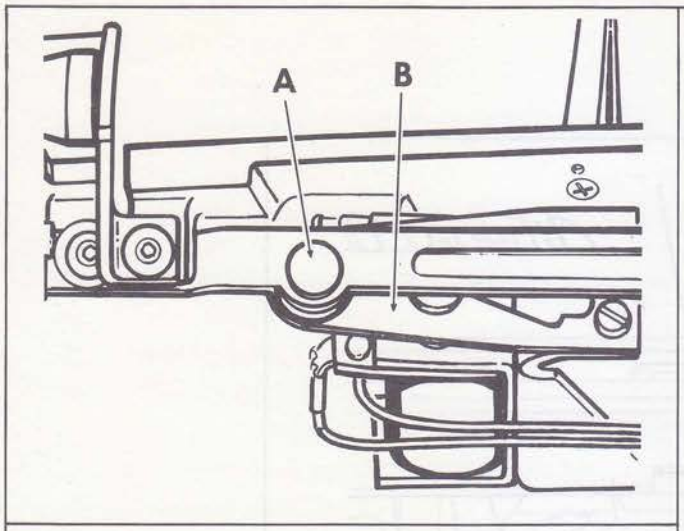
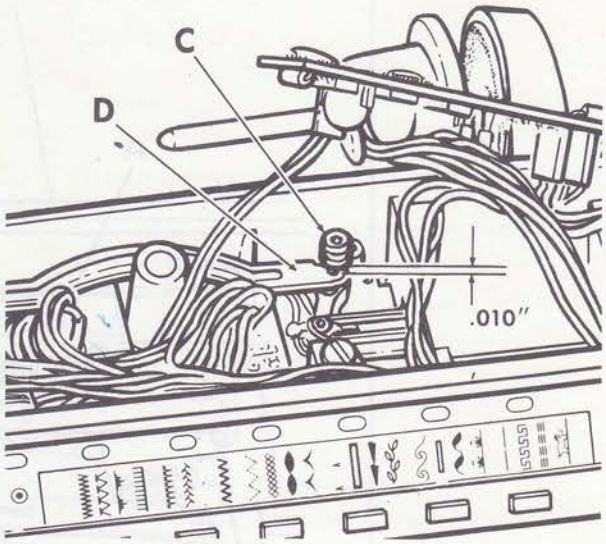
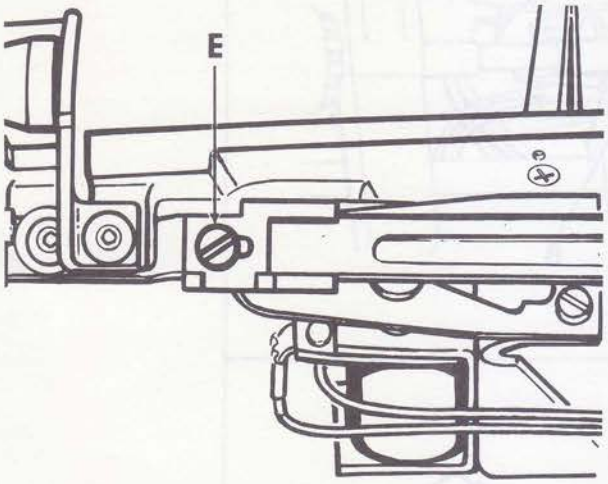

A
B


C
D
.010"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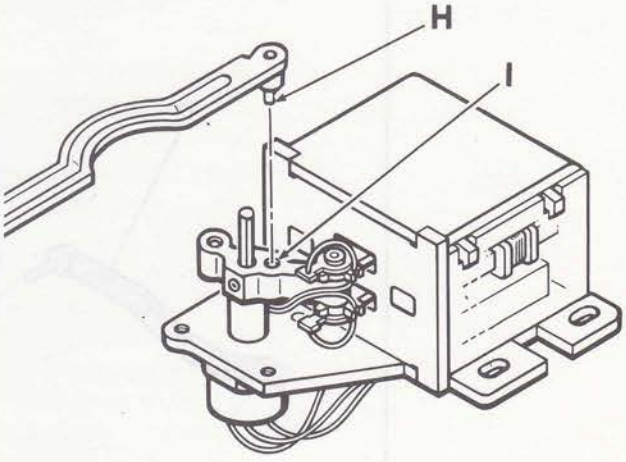
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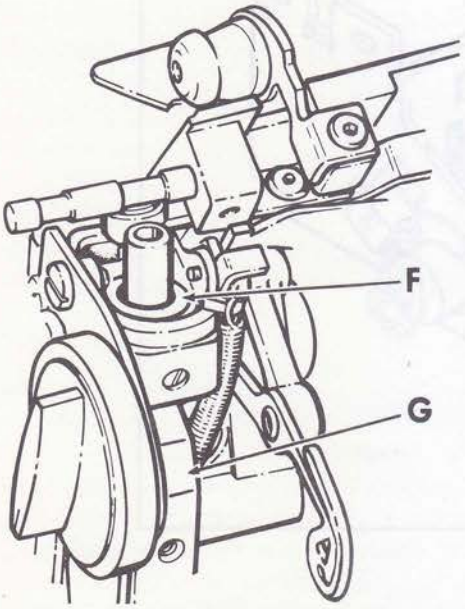
I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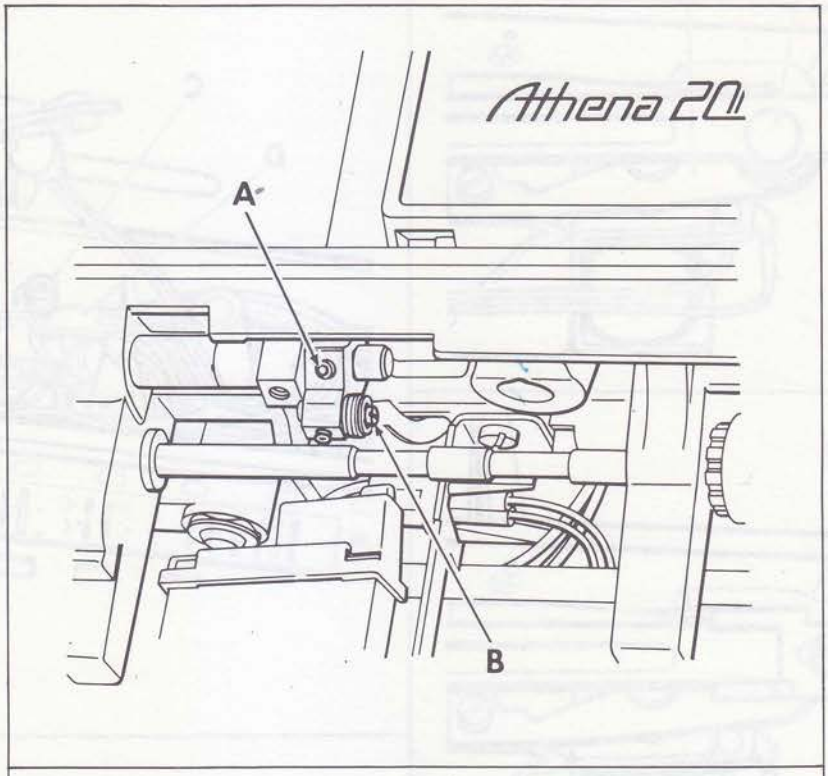
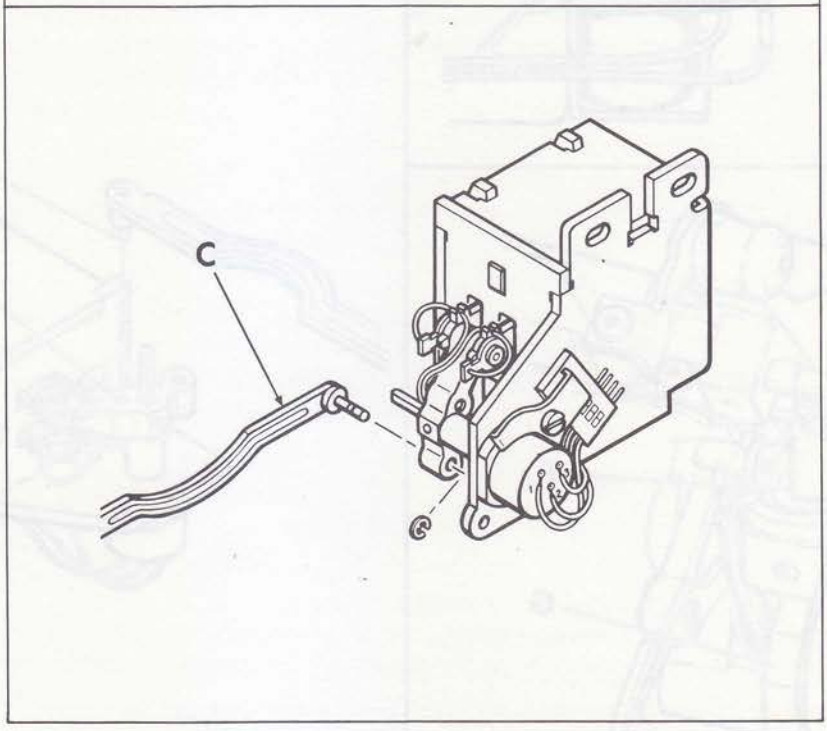
G





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FEED MECHANISM

Machine Setting:

1. Pattern Selection: Honeycomb.
2. Presser Foot: Up.

Check:

1. Read feed error voltage at TP-8 on the servo P.C. board.
2. Rotate hand wheel by hand through six complete revolutions.
3. Observe readings at the different positions of the linear feed motor.
4. At no time must the voltage exceed ± 2.2VDC MAXIMUM when using a digital meter, ± 2.4VDC using an analog meter.

NOTE: If during the adjustment sequence the voltage reading falls below the maximum allowable, the feed mechanism is to be considered free of binds.

Adjustment:

1. Remove needle plate to eliminate possible interference of feed dogs with needle plate slots. Recheck voltage reading. Adjust feed dog location if voltage reading drops.
2. Loosen feed regulator shaft crank set screw **A** and run machine momentarily to allow crank to locate itself laterally on the feed regulator shaft.
3. Tighten set screw **A** taking care not to upset lateral position of crank. Recheck voltage reading.
4. Reset zero feed eccentric **B** being sure throw of the eccentric is toward the bottom of the machine. Recheck voltage reading.
5. Turn power off. Check for free movement of feed connecting link **C,** at pin end, in linear motor crank. Move link back and forth 1/4". There should be no binding and there should be a very slight lateral movement. Shape connecting link **C** if necessary, to obtain proper fit. Recheck voltage.
6. Remove feed connecting link **C.** Recheck voltage. MAXIMUM allowable voltage ± 1.0VDC. Motors reading over maximum are to be replaced.
7. Replace feed connecting link **C.** Reset feed regulator shaft crank and zero feed. Recheck voltage.
8. If correct voltage readings cannot be attained, the entire Alpha feed system must be checked for proper alignment and freeness.
   a. Feed Regulator and Slide Block.
   b. Feed Regulator Shaft.
   c. Feed Regulator Shaft Collars.
   d. Feed Drive Shaft.
   e. Feed Bar Connecting Link.
   f. Feed Bar Pivots.
   g. Feed Compensating Link.
   h. Feed Dog Holder.

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SECTION 4
ADJUSTMENT PROCEDURES

INTERLOCKING ADJUSTMENTS

Many of the 2000 machine adjustments interlock with each other. The following pages provide a convenient cross-reference of sequential check-out procedure, the related adjustment procedure, and interlocking adjustments.

The first column provides a sequential checklist of tests or verifications for a complete mechanical check of a machine. The second column provides a list of adjustment procedures keyed to the sequential checklist. The third column provides a list of any interlocking adjustments that must be verified before performing an adjustment listed in the second column.

FAILURE TO FOLLOW THE SEQUENTIAL ORDER OF ADJUSTMENTS CAN RESULT IN SELF-DEFEATING EFFORT AND TIME-CONSUMING READJUSTMENTS.

SEQUENTIAL CHECKLIST AND INTERLOCKING ADJUSTMENTS CROSS REFERENCE

SEQUENTIAL CHECKLIST	ADJUSTMENT PROCEDURE	PAGE	INTERLOCKING ADJUSTMENTS TO BE VERIFIED BEFORE ADJUSTMENT PROCEDURE
1. Arm Shaft a. End Play b. Rotative Play	1. ARM SHAFT AND ARM SHAFT SPROCKET	36	1. None
2. Ease of Threading Arm Top of Thread Guide	2. ARM TOP THREAD GUIDE AND PRETENSION	36	2. None
3. Lost Motion a. Needle Bar b. Take Up Lever and Connecting Link	3. TAKE UP LEVER AND NEEDLE BAR CONNECTING LINK LOST MOTION	39	3. Adjustment 6 (Latch Carrier Eccentric Only)
4. Needle Bar Play Front to Rear	4. a. NEEDLE BAR VIBRATING BRACKET BALL JOINT b. NEEDLE BAR VIBRATING BALL STUD	39	4. None
5. Needle Location in Straight Stitch (Round Hole) Needle Plate a. Front to Back b. Left to Right	5. a. NEEDLE BAR DRIVING ARM POSITIONING SOLENOID b. SETTING NEEDLE LOCATION	40 43	5. a. Adjustment 3 b. Adjustment 4
6. Needle Bar a. Height b. Radial Position c. Noise d. Double Latching e. Failure to Latch	6. a. NEEDLE BAR HEIGHT b. INSPECTION AND LUBRICATION OF NEEDLE BAR LOCK MECHANISM c. NEEDLE BAR RECOIL SPRING d. NEEDLE BAR LATCH CARRIER ECCENTRIC e. NEEDLE BAR CLAMP AND GUIDE STUD ADJUSTING PLATE f. NEEDLE BAR HIGH LIFT ADJUSTING BRACKET g. NEEDLE BAR RELEASE SOLENOID	44 47 48 48 51 52 55	6. a. Adjustment 3
7. Presser Bar Functions	7. PRESSER BAR HEIGHT, ALIGNMENT AND PRESSURE	56	7. None
8. Timing Belt	8. TIMING BELT TENSION	59	8. None
9. Motor Belt - Power Switch	9. MOTOR BELT TENSION AND MOTOR SWITCH	59	9. None
10. Crossover	10. NEEDLE CROSSOVER - TIMING THE SHUNT	60	10. a. Adjustment 3 b. Adjustment 4 c. Adjustment 6

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SEQUENTIAL CHECKLIST AND INTERLOCKING ADJUSTMENTS CROSS REFERENCE

SEQUENTIAL CHECKLIST	ADJUSTMENT PROCEDURE	PAGE	INTERLOCKING ADJUSTMENTS TO BE VERIFIED BEFORE ADJUSTMENT PROCEDURE
11. Hook a. End Play 1. Hook Shaft 2. Hook Drive Shaft b. Gear Mesh	11. REFER TO SECTION 5 a. HOOK REPLACEMENT b. HOOK DRIVE SHAFT REPLACEMENT	116	11. None
12. Timing a. Hook Time b. Feed Time	12. HOOK AND FEED TIMING	63	12. a. Adjustment 3 b. Adjustment 4 c. Adjustment 8 d. Adjustment 11
13. Hook to Needle Relationship	13. HOOK TO NEEDLE RELATIONSHIP (RESET GEAR MESH: REFER TO ADJUSTMENT 11)	64	13. a. Adjustment 3 b. Adjustment 4 c. Adjustment 5
14. Alpha Feed System a. Needle Plate Magnet Height b. Feed Dog 1. Centralizing 2. Throw 3. Height c. Zero Feed	14. ALPHA FEED SYSTEM	67	14. None
15. Thread Clearances	15. BOBBIN CASE THREAD CLEARANCES.	71	15. a. Adjustment 12 b. Adjustment 13
16. Needle Thread Tension a. Dial Tension b. Thread Take-up c. Tension Release	16. TENSION MODULE	76	16. Adjustment 10
17. Chainstitching	17. REFER TO INTERLOCKING ADJUSTMENTS		17. a. Adjustment 5 b. Adjustment 6 c. Adjustment 12 d. Adjustment 13 e. Adjustment 14 f. Adjustment 15 g. Adjustment 16
18. Buttonholes	18. BUTTONHOLE SWITCH	79	18. None
19. Electrical	19. ELECTRICAL SYSTEM	80	19. None
20. Lubrication	20. LUBRICATION INSTRUCTIONS	83	20. None
21. Final Sew In	21. SEW IN TEST	84	21. None

ARM SHAFT AND ARM SHAFT SPROCKET

ELIMINATING END PLAY

Preparation:

1. Remove face plate and arm top cover.

Check:

Hold arm shaft crank against bushing and push in and out on hand wheel to be sure there is no lateral play in the arm shaft sprocket. Release the arm shaft crank and push in and out on arm shaft by means of hand wheel. Repeat this procedure at three radial positions of the arm shaft, each position equidistant from the other. If there is one point without end play in a complete rotation of arm shaft, no adjustment is needed even though end play may exist in other positions.

Adjustment:

1. Turn arm shaft toward front of machine until screw **A**, that holds arm shaft collar **B**, is in position to loosen. Loosen screw **A**.
2. While pushing arm shaft crank **C** against front bushing **D**, slide arm shaft collar **B** until it just touches front bushing **D** and tighten arm shaft collar screw **A**.
3. Recheck for end play and readjust if necessary.

ELIMINATING RADIAL AND LATERAL LOOSENESS OF ARM SHAFT SPROCKET

Check:

Hold arm shaft at crank end and check arm shaft sprocket for radial (rotative) or lateral movement.

Preparation:

1. Remove servo board mounting screws.
2. Remove hand wheel.

Adjustment:

1. Set a clearance of .010" between sprocket and arm casting and tighten cone-pointed hex screw **E** in "V" groove of arm shaft.

ARM TOP THREAD GUIDE AND PRE-TENSION

Function:

The thread guide assembly acts not only as a self-threading thread guide but also provides the pre-tension necessary to properly fill bobbins.

When presser bar is raised or tension dial is set to "0", the pre-tension supplies 5 to 15 grams of control on the needle thread. Bobbins that are soft to the fingernail test or have snarled coils of thread, signify very low or non-existent pre-tension values.

Excessive pre-tension can cause thread breakage.

Incorrect location of the assembly can cause difficulty in threading.

Preparation:

1. Remove arm top cover.

Adjustment:

1. Loosen set screw **J**.
2. Align right vertical surface of assembly bracket **H** parallel to arm casting boss **I** and tighten set screw **J**.
3. Loosen set screw **F** inside adjusting nut **G**.
4. Turn pre-tension adjusting nut clockwise to increase tension, counterclockwise to decrease tension.
5. Test by drawing a piece of thread through the pre-tension and feeling for a barely perceptible drag (5-15 grams).
6. Hold position of adjusting nut **G** and tighten set screw **F**.
7. Recheck by filling two bobbins.

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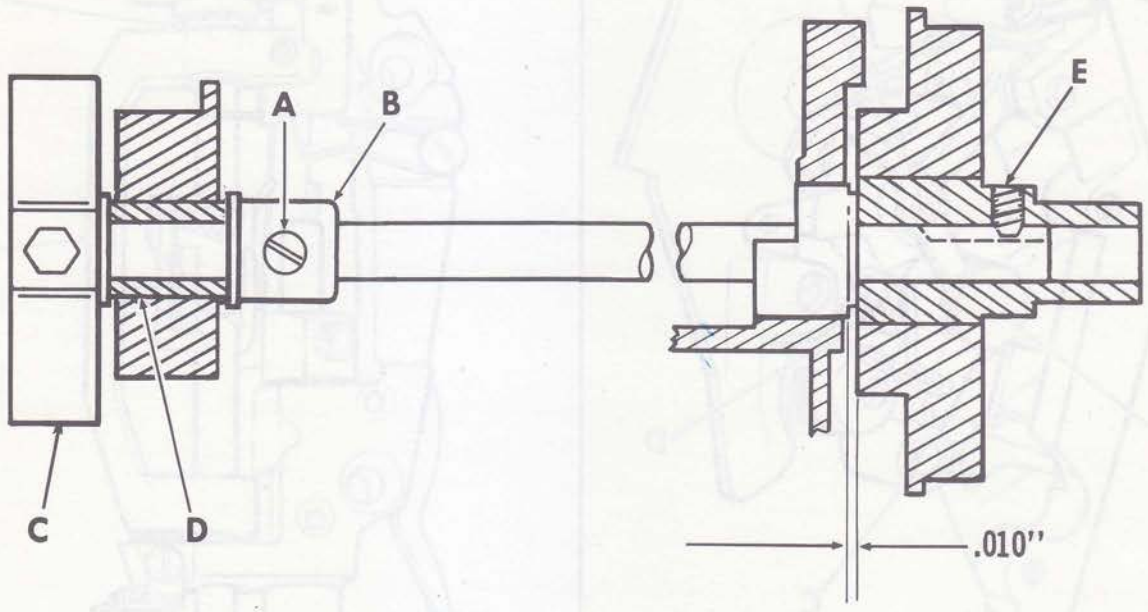
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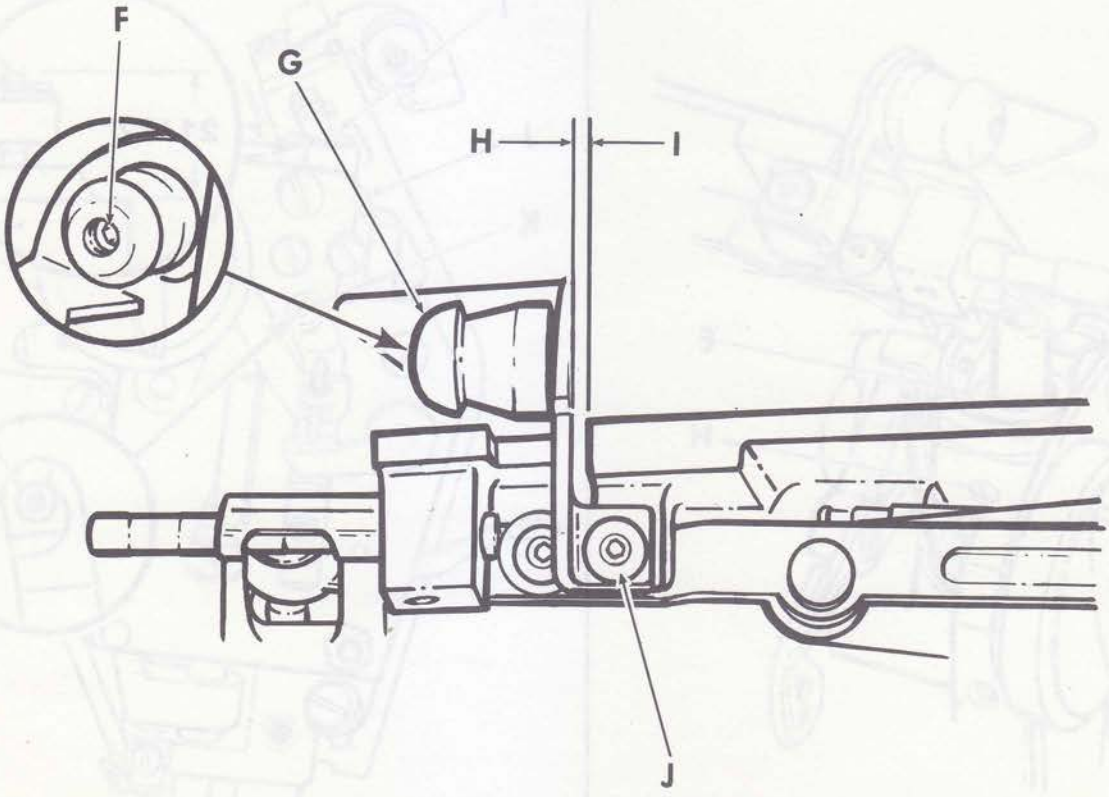
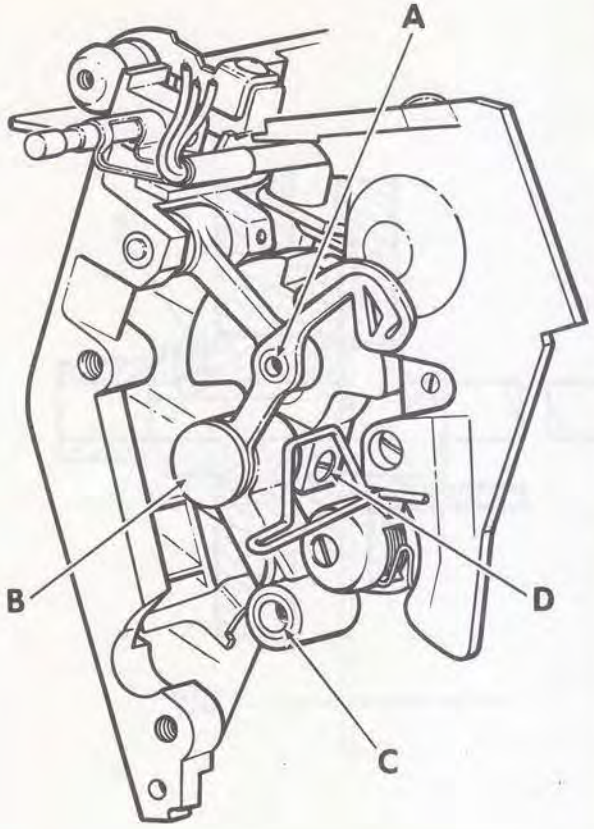
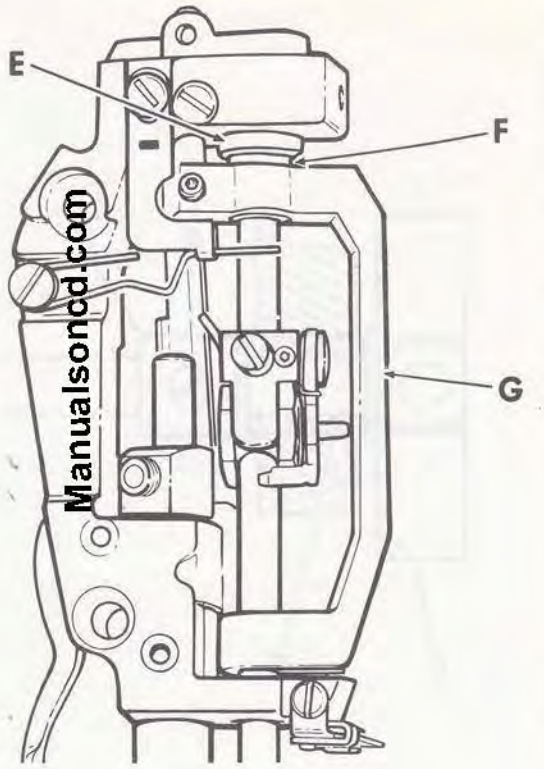
.010"


F
G
H
I
J





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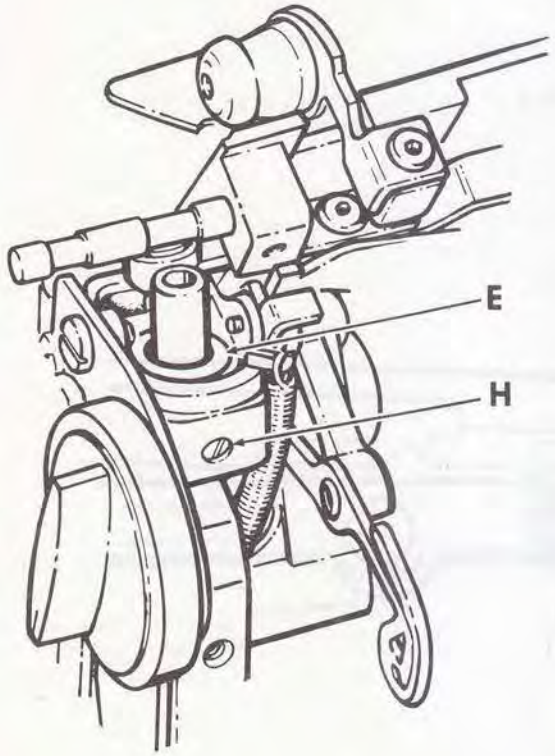

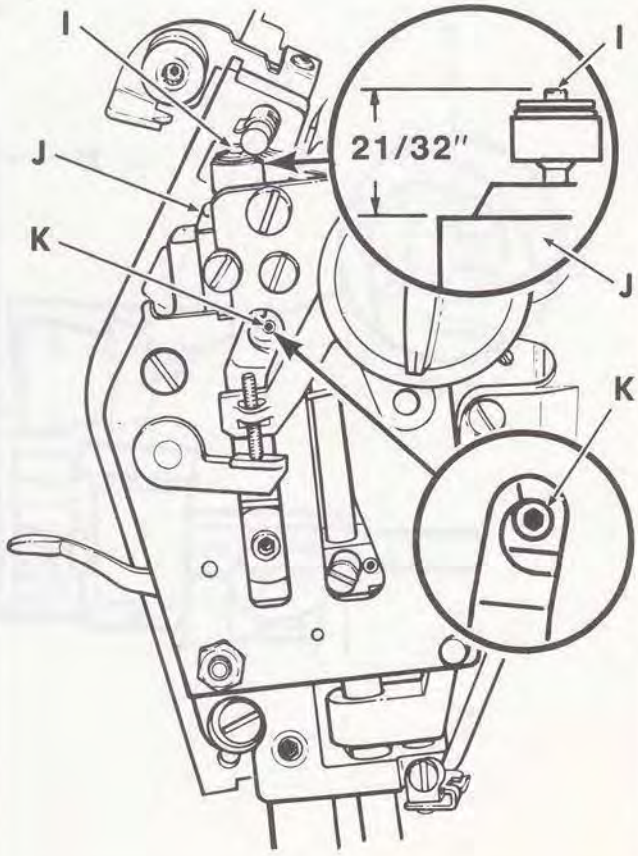

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THREAD TAKE-UP LEVER AND NEEDLE BAR CONNECTING LINK LOST MOTION

Machine Settings:
1. Pattern Selector: Straight Stitch

Check:
1. Run machine at high speed. Check for rapping noise in head-end area.

Preparation:
1. Remove face plate and arm top cover.
2. Check for wear (out of round) in holes of needle bar connecting link **C,** with needle bar in down position, by grasping needle bar and working it up and down. Check for lost motion in thread take-up lever **A;** check rivet for tightness. Check that thread take-up eccentric crank **B** is firmly seated in connecting link **C,** and that set screw **D** is properly seated on the flat of crank **B.**

Adjustment:
1. Remove head-end assembly.
2. Replace a loose thread take-up lever assembly with a new one.

NEEDLE BAR VIBRATING BRACKET BALL JOINT

The needle bar vibrating bracket has one adjustable bearing (ball) joint **F** located at the top of the needle bar vibrating bracket **G.** The ball joint is held in position by a needle bar bushing (upper) **E.** There should be no vertical looseness, yet needle bar vibrating bracket must swing freely.

Machine Settings:
1. Pattern Selector: Straight Stitch

Preparation:
1. Remove face plate and arm top cover.

Check:
1. Check needle bar vibrating bracket **G** for vertical looseness.

Adjustment:
1. Loosen set screw **H** on the needle bar frame.
2. With the left hand, use a screw driver to push down bushing **E.** Use just sufficient pressure to eliminate vertical looseness of needle bar vibrating bracket and still allow it to swing freely.
3. Tighten set screw **H,** and recheck.
4. Perfom bind test for bight mechanism and readjust if necessary.

NEEDLE BAR VIBRATING BRACKET BALL STUD

Ball stud **I** has an annular recess for clearance against interference with needle bar frame **J.** However, it is possible to cause hang-ups if the height is not carefully set. The correct amount of needle swing also depends on the correct height setting of the ball stud.

Machine Settings:
1. Stitch Selection: Straight Stitch

Preparation:
1. Remove face plate.
2. Remove buttonhole switch.

Check:
1. With a straight edge rule, measure from the milled surface **J** of the head frame to the top of the needle bar vibrating bracket ball stud **I.** Use a small strip of shim stock layed flat across the top of the stud to facilitate the measurement. The distance should measure 21/32".

Adjustment:
1. Loosen set screw **K** and raise or lower stud **I** as required.
2. Tighten set screw **K.**
3. Perform bind test.
4. Replace buttonhole switch and adjust.

NEEDLE BAR DRIVING ARM POSITIONING SOLENOID

Preparation:

1. Remove face plate.
2. Remove top cover.
3. Remove servo board mounting screws but do not remove servo board.
4. Tilt up servo board to gain access to TP-15.

Machine Setting:

1. Stitch Selection: Straight Stitch.
2. Install straight-stitch needle plate.

Check:

1. Read bight error voltage at TP-15 on the Servo board.
2. If reading is within specification (±1.8VDC MAXIMUM when using a digital meter) the positioning solenoid lever **B** is properly positioned.
3. If reading is outside of specification, depress lever **B.** If reading is lowered or falls below maximum specification, the needle bar driving arm stud **A** must be relocated.

Adjustment:

Earlier Production:

1. Loosen linear bight motor mounting screws **C** and **D.**
2. Shift motor and needle bar driving arm assembly left or right as needed until lever **B** properly seats on stud **A.**
3. Push motor toward front of the machine so both bracket holes butt firmly against mounting screws **C** and **D.**
4. Tighten mounting screws **C** and **D** and recheck bight error voltage. Readjust if necessary.
5. Reset needle location.

Later Production:

1. Loosen screw **E** on adjustable needle bar driving arm stud **F.**
2. Shift adjustable stud **F** left or right as needed until lever **B** properly seats on stud **F.**
3. Tighten screw **E** and recheck bight error voltage. Readjust if necessary.

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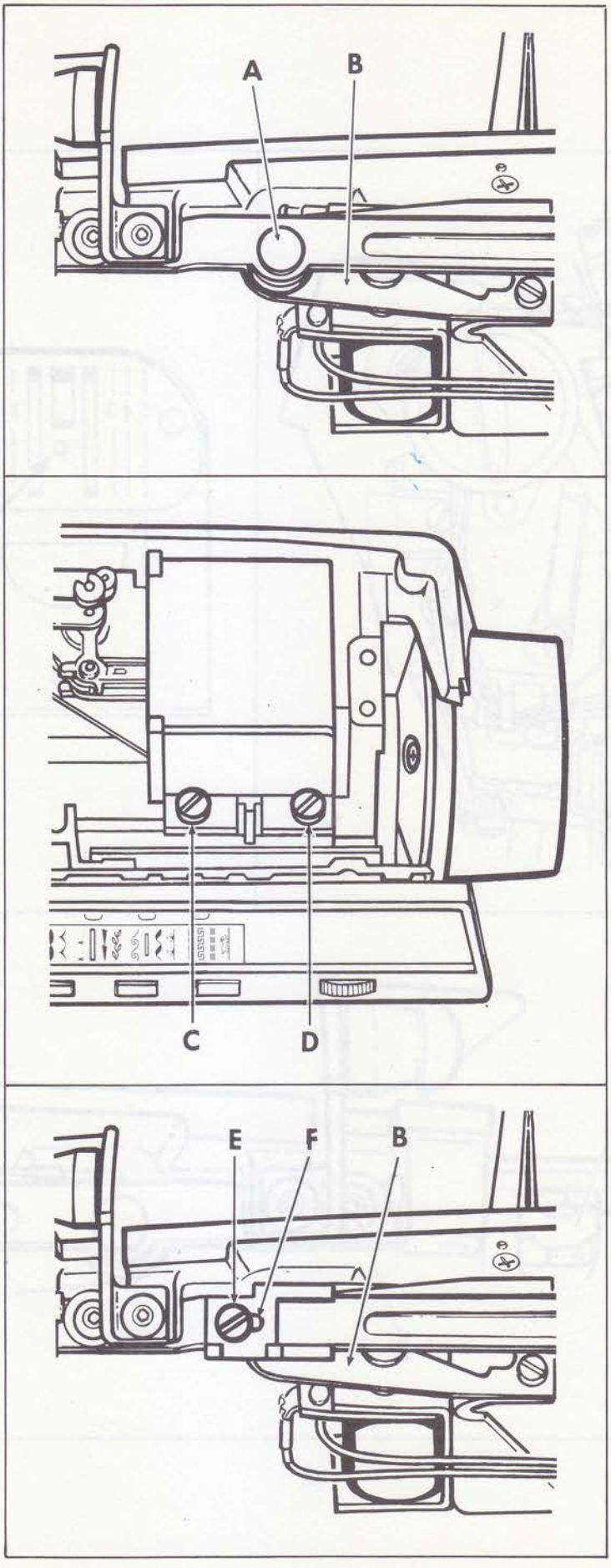
A
B
C
D
E
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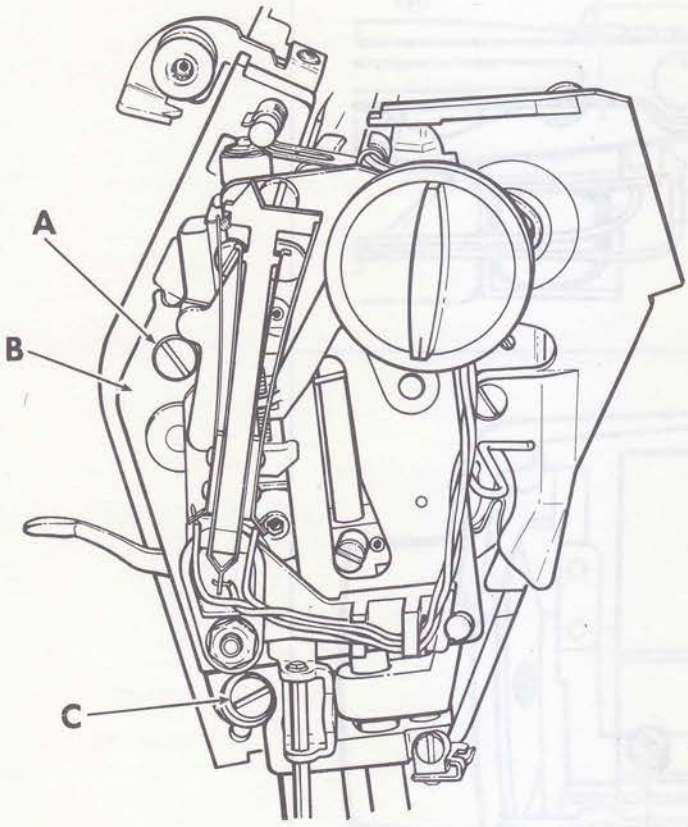
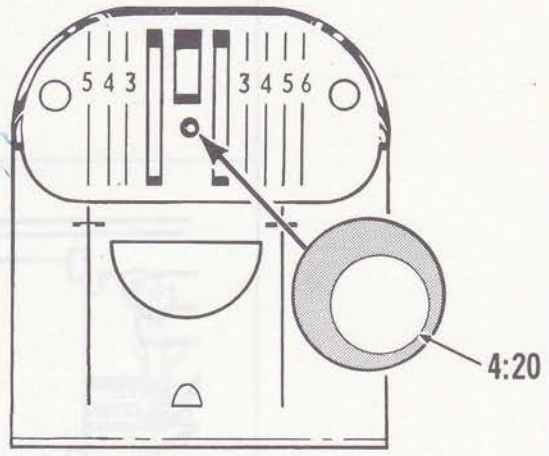
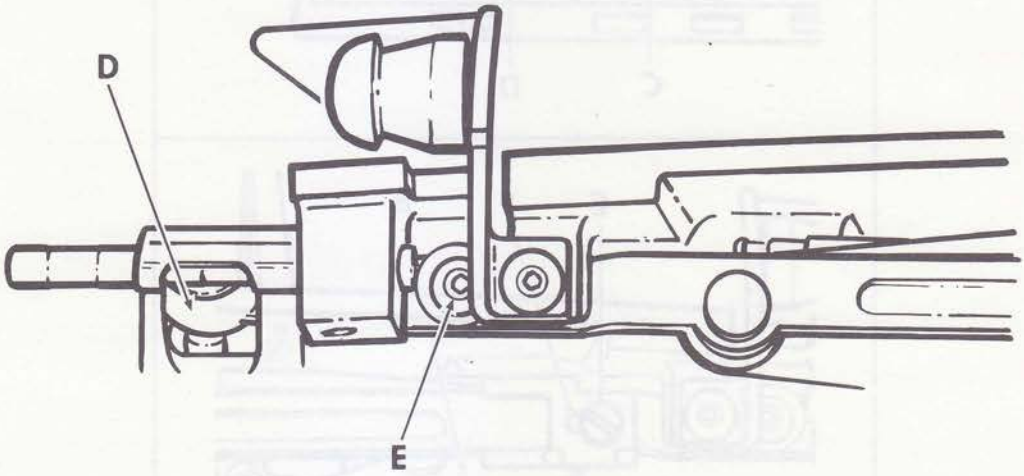
B







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SETTING NEEDLE LOCATION

Machine Setting:

1. Stitch Selection: Straight Stitch
2. Insert size 18 needle or needle plug.

Preparation:

1. Remove face plate and arm top cover.
2. Remove servo board mounting screws, but do not disconnect harnesses.

Check:

1. Verify linear bight motor offset and scale voltages at test point 8 on the digital board.
2. Verify linear bight motor position signal (feed-back voltage) at test point 11 on the servo board.
3. Verify linear bight motor correction signal at test point 15 on the servo board.
4. Verify zero location of linear bight motor bobbin.
5. Install straight-stitch needle plate and check for correct positioning of needle bar driving arm positioning solenoid lever.
6. Turn hand wheel to position needle or needle plug into needle hole. Needle or plug should be in the 4:20 clockhand location.

SETTING FRONT-TO-BACK NEEDLE LOCATION, USING HEAD-END MODULE

Adjustment:

1. Loosen upper pivot screw **A,** but pinch slightly for control reasons.
2. Loosen lower screw **C.**
3. Move module **B** to locate needle or plug between "4" and "5" clockhand position.
4. Securely fasten lower screw **C,** then upper screw **A;** recheck needle position.
5. Recheck hook to needle (or plug) clearance.

SETTING LEFT-TO-RIGHT NEEDLE LOCATION

The needle or plug, for best sewing results, should be between "4" and "5" clockhand location. This setting will prevent needle interference in left swing position.

Adjustment:

1. Loosen screw **E** joining needle bar ball joint **D** to needle bar driving arm. Maintain a pinch on screw **E** to control fine setting.
2. Move ball joint **D** to achieve 4:20 clockhand setting. Tighten screw **E** and recheck. Run machine at slow and fast speeds and recheck.
3. Insert zig-zag needle plate into machine. Select zig-zag pattern.
4. Run machine at full speed for thirty seconds.
5. Insert round hole needle plate into machine. Select straight stitch.
6. Recheck for 4:20 clockhand setting.

NEEDLE BAR HEIGHT

Function of Timing Lines

Two lines are cut into the lower end of needle bar to represent the needle rise required to form a thread loop for hook point seizure.

Machine Settings:

1. Stitch Selection: Straight Stitch
2. Needle or Plug: Size 18

Preparation:

1. Remove face plate.
2. Place a 3/8" wide scale **F** or strip of sheet metal on top of presser foot thumb screw **G.** With left hand, raise presser bar lifter **B** and hold scale against presser bar bushing **D.** This action will clamp scale in position to use as a reference point for checking hook time.

Check:

1. Check for correct hook gear mesh.
2. Turn hand wheel toward front of machine to bring needle bar to its lowest position. Check that upper timing line **C** is parallel with the bottom of presser bar bushing **D.**
3. Turn hand wheel to bring lower timing line **E** to top edge of reference scale and check hook point location. The point of the hook should be at the center of the needle. Adjust hook timing if necessary.
4. Select zig-zag. Turn hand wheel to move hook point to rear of needle, when needle is in left zig-zag position. The top of the needle eye should be 1/64" to 1/32" below the underside of hook point.

Adjustment:

Loosen needle bar clamping screw **A** and raise or lower needle bar to suit the left needle position requirements. Tighten screw **A.** Check radial position of needle bar by turning hand wheel to position needle or tip of plug into needle hole of round hole needle plate; needle or plug should be in a 4:20 clockhand location. Needle clamp hub **H** should be parallel with front edge of bed. Tighten screw **A** securely.

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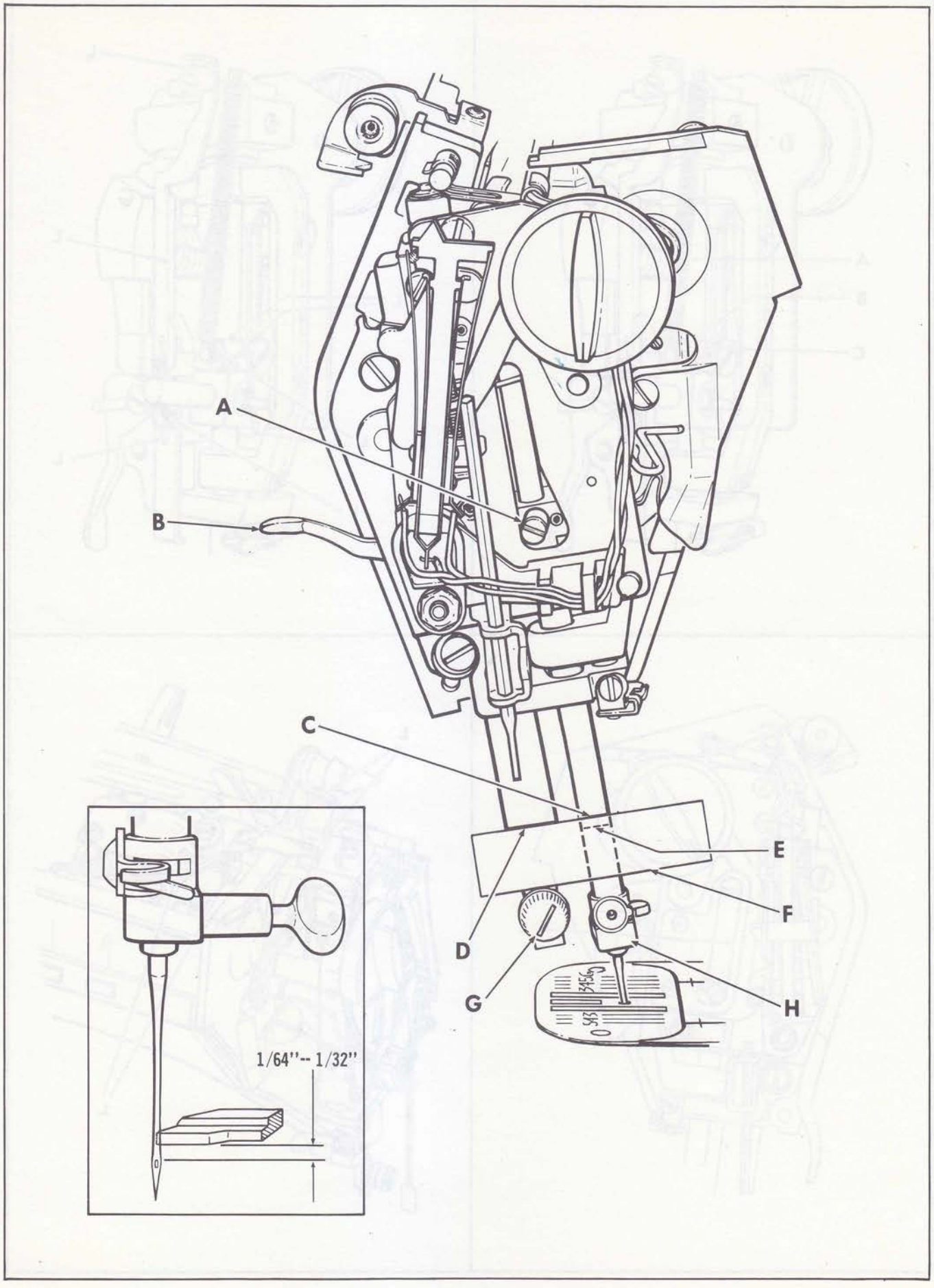
A
B
C
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G
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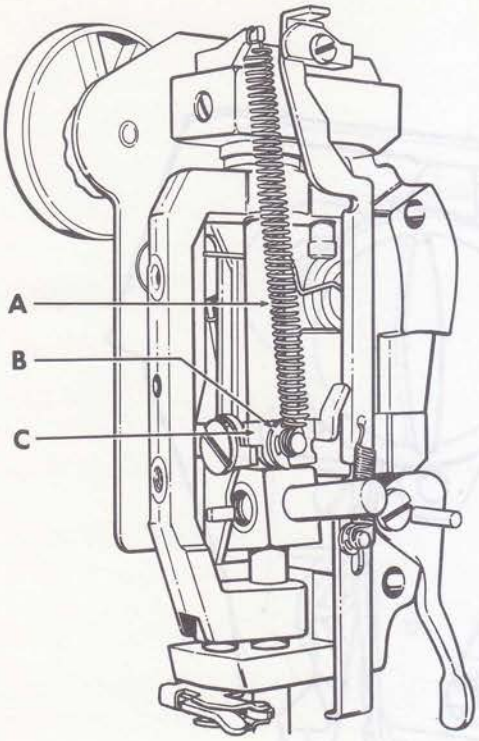
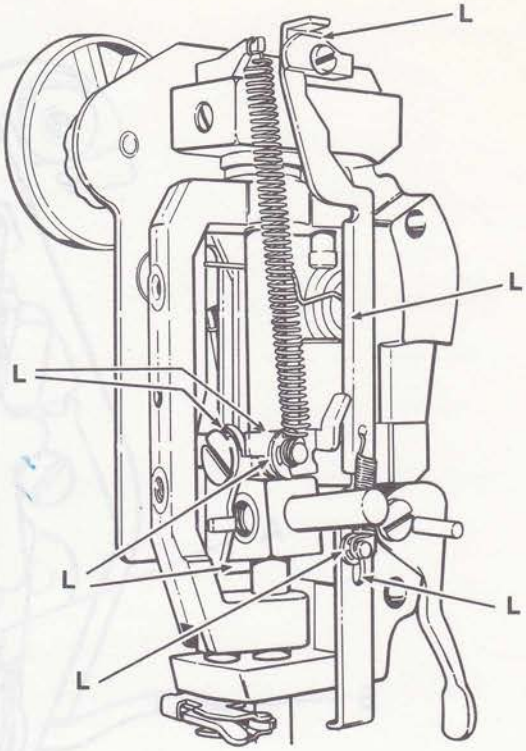
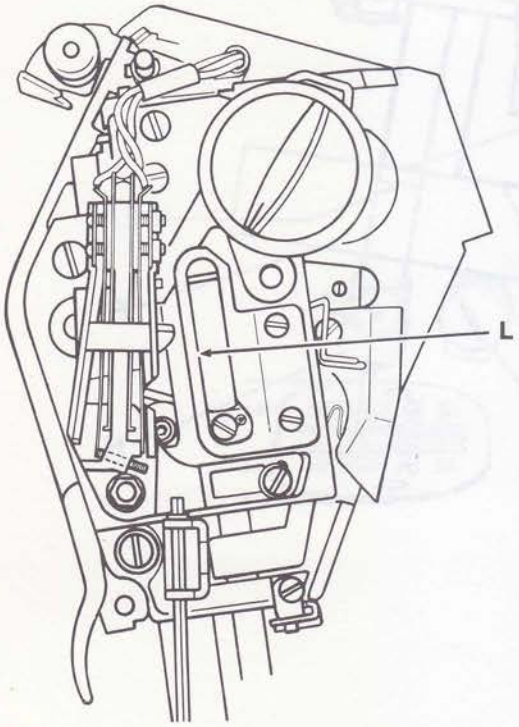
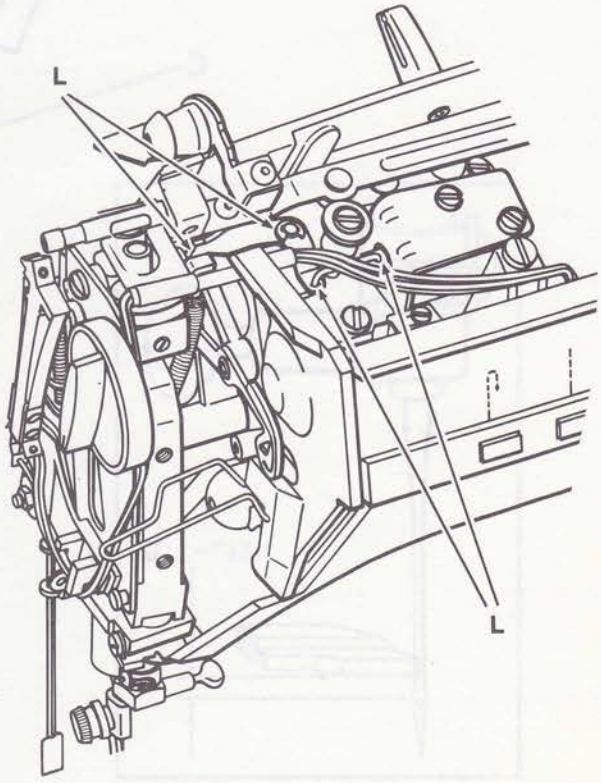
1/64"-- 1/32"









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INSPECTION AND LUBRICATION OF NEEDLE BAR LOCK MECHANISM

Preparation:

1. Remove face plate and arm top cover.

Inspection:

1. Raise needle bar to its highest point and remove needle bar return spring **A.**
2. Lower needle bar to its lowest point and remove releasing lever retaining ring **B.**
3. Close inspection of retaining ring **B** will show the inside edge on one side of the ring to have a slight radius (curve). Reassemble with the radius side against the releasing lever **C.**
4. Replace spring **A.**

Lubrication:

1. Lubricate the areas indicated "**L**", with "Lubriplate 107" only. Sufficient amounts must be applied to provide lubrication to all internal points, pivots, etc.

NEEDLE BAR RECOIL SPRING

Machine Settings:
1. Stitch Selection: Straight Stitch.

Preparation:
1. Remove face plate.

Check:
1. Turn hand wheel toward front of machine until needle bar is at the extreme top of its stroke.
2. Needle bar clamping screw **E** should slightly deflect (lift) recoil spring **D.**
3. Rock hand wheel back and forth to observe deflection of recoil spring. Generally, the less recoil spring **D** is deflected, the better the setting. Under certain conditions, however, this deflection may be as much as, or more, than .010" to provide successful maxi-stretch stitch operation. If recoil spring **D** does not deflect, needle bar latch **F** does not engage.

Adjustment:
1. Loosen screw **C** holding recoil spring bracket **A.**
2. Using blade of a small screwdriver engaged in slot **B** move bracket **A** up to decrease deflection, down to increase deflection of recoil spring **D.**
3. Tighten screw **C.**
4. Recheck for correct deflection of recoil spring and/or excessive noise.
5. Check machine in basting.

NEEDLE BAR LATCH CARRIER ECCENTRIC

Machine Settings:
1. Stitch Selection: Straight Stitch

Preparation:
1. Remove face plate.

Check:
1. Needle bar latch **J** must disengage and return into latched position, without bind or hesitation when latch is released gently.
2. Clearance between underside of latch carrier **G** and top of connecting stud **I** must be .001" to .003" when they are latched together.

Adjustment:
1. Select zig-zag.
2. Turn hand wheel toward front of machine until needle is at its lowest point in the left hand position so as to provide access between mounting plate **K** and needle bar vibrating bracket **L** to eccentric stud **F.**
3. Loosen eccentric set screw **H.**
4. While connecting stud **I** is resting on latch carrier **G,** turn eccentric **F** until a clearance of .001" to .003" is obtained. High point of eccentric **F** must be facing needle bar clamping screw.
5. Tighten set screw **H.**
6. Recheck in straight stitch and readjust if necessary.
7. Check machine in basting.

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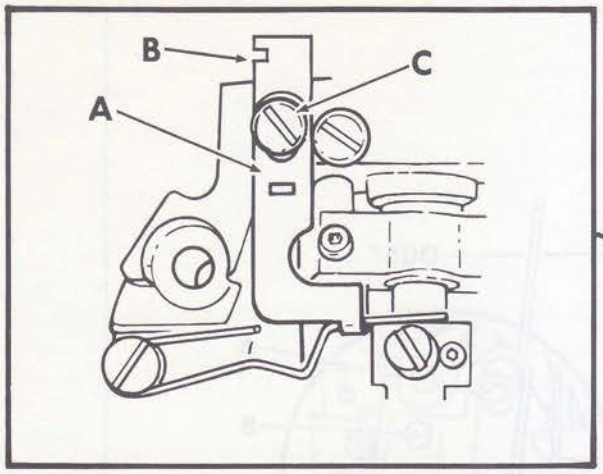
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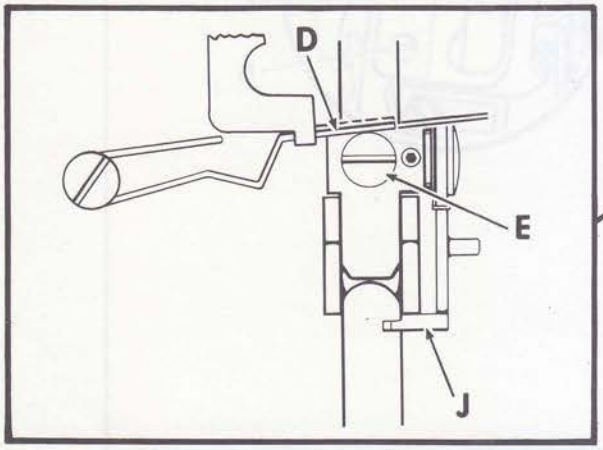
D
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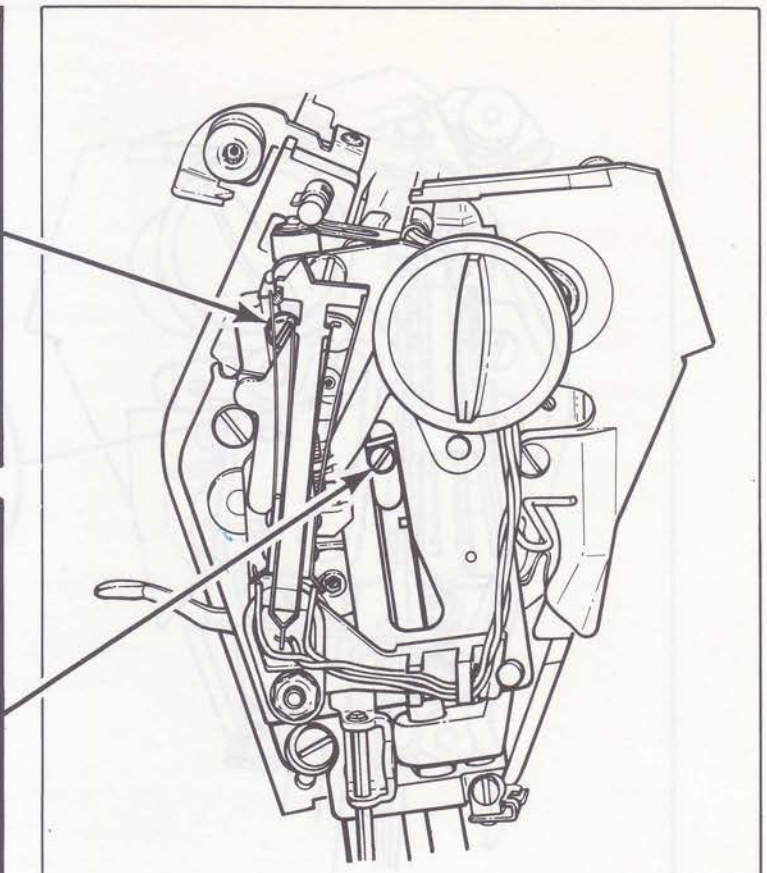

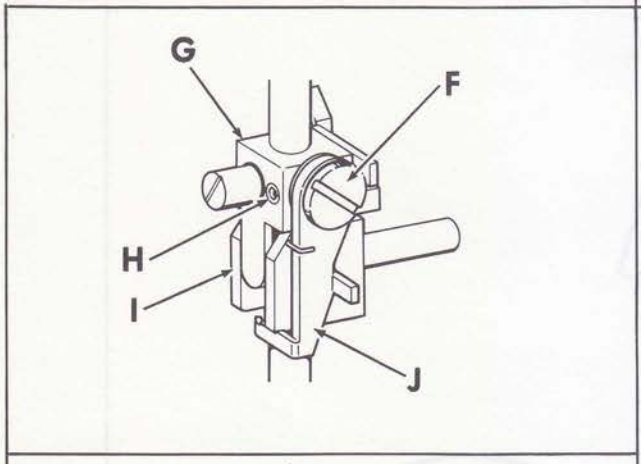
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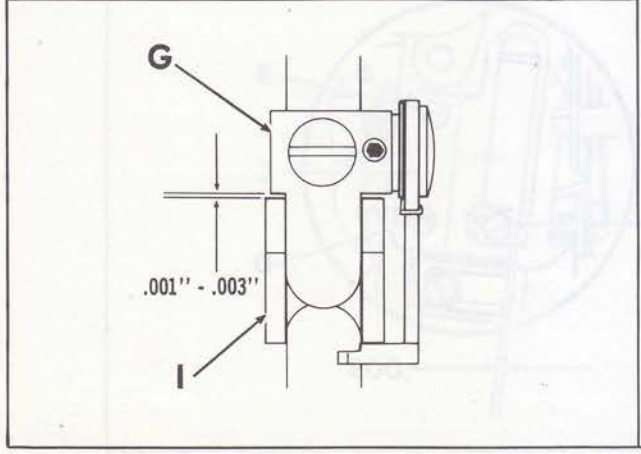
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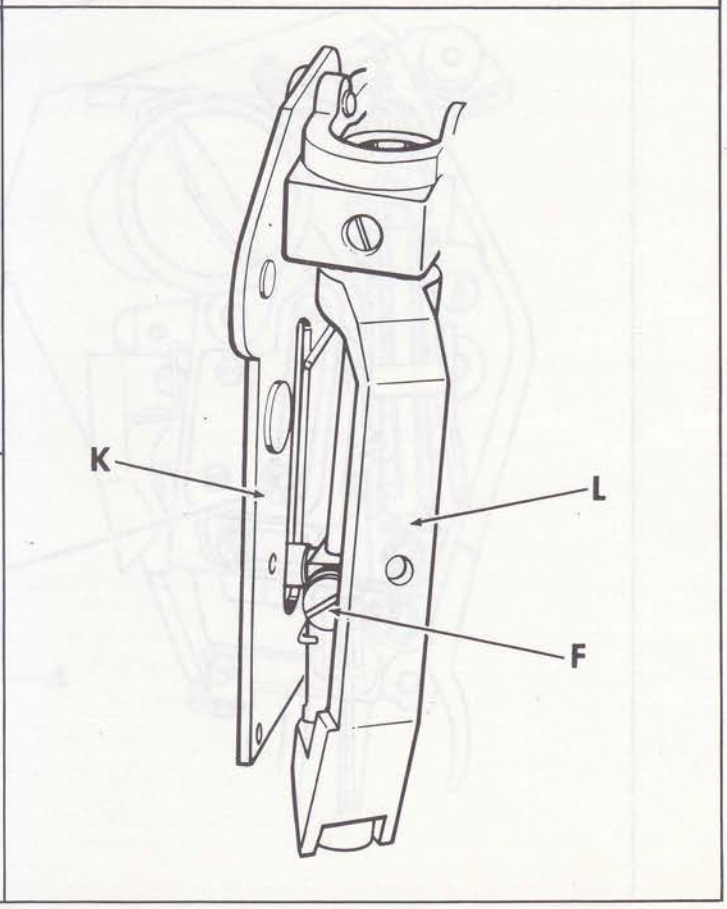
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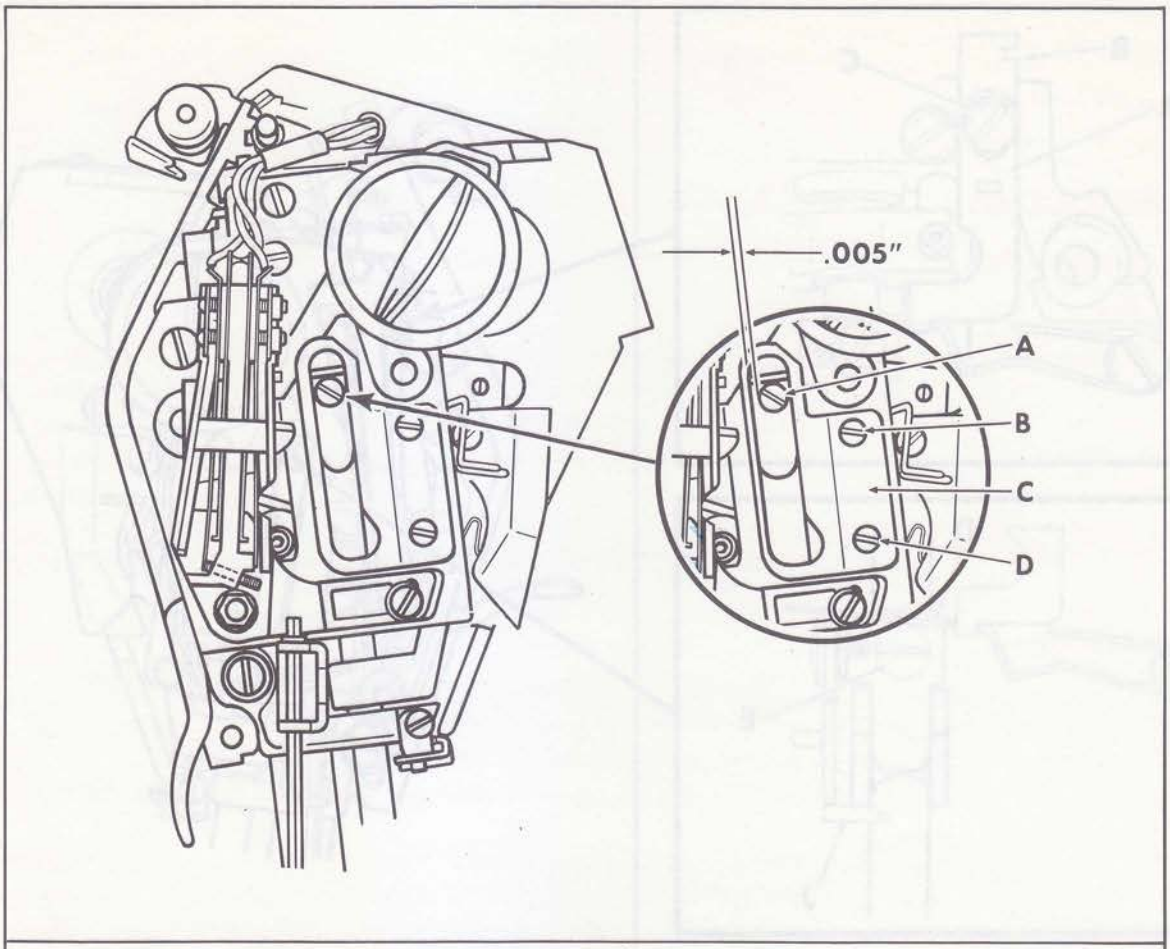

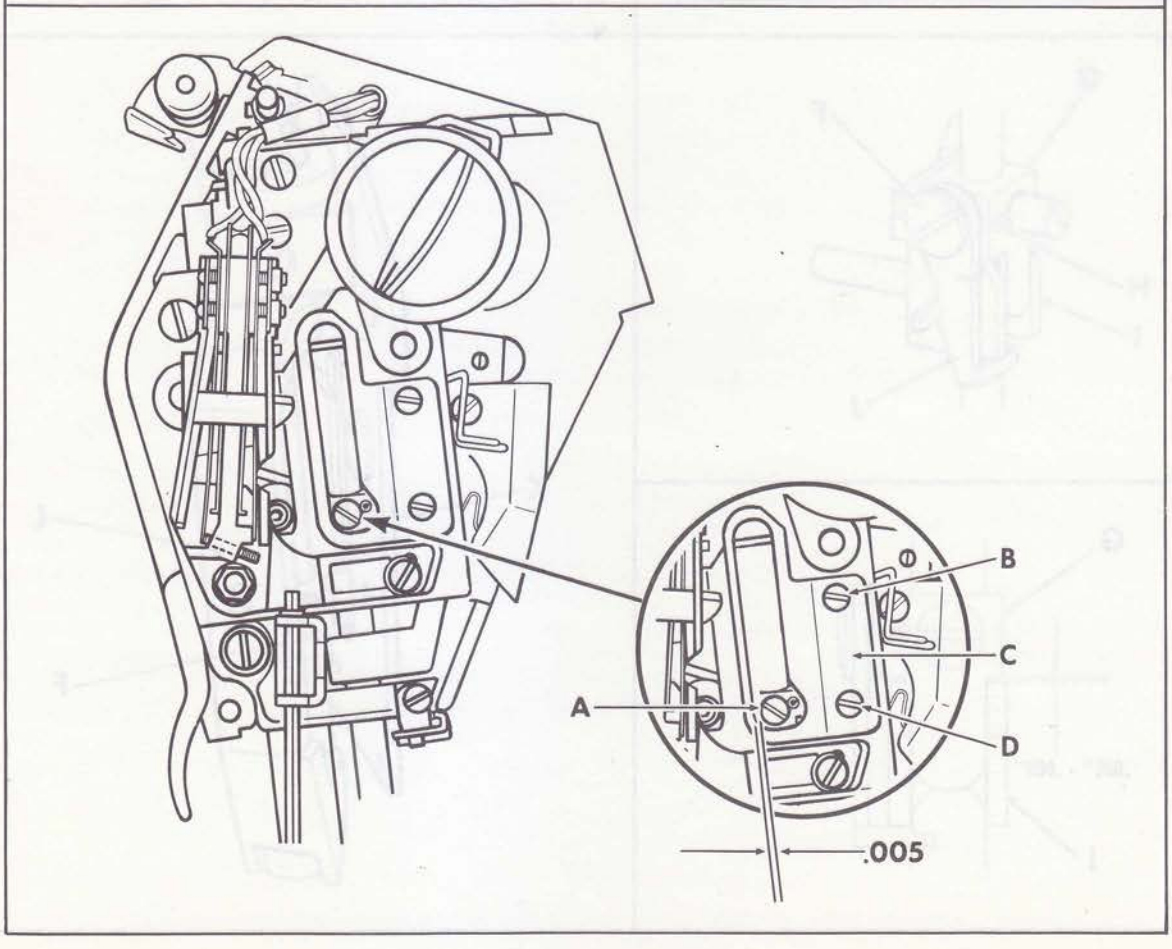

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NEEDLE BAR CLAMP AND GUIDE STUD ADJUSTING PLATE

Machine Settings:

1. Stitch Selection: Straight Stitch — Single Pattern

Preparation:

1. Remove face plate.

Check:

1. Run machine very slowly and observe needle bar. There must be no radial movement to the needle bar as this action occurs.
2. Select Straight Stitch.
3. With needle bar at both top and bottom dead center, there must be a minimum of .005" clearance between the needle bar clamping and guide stud **A** and adjusting plate **C** when the needle bar is rotated in a counterclockwise direction as viewed from the top.

Adjustment:

1. Select Straight Stitch.
2. Rotate hand wheel to bring needle bar to its highest point.
3. Loosen screw **D** to pinch tightness.
4. Loosen screw **B.**
5. Rotate needle bar in a counterclockwise direction as far as possible.
6. While holding the needle bar in this position, move adjusting plate **C** toward the front or rear of the machine, as required, to obtain a minimum clearance of .005", as measured with a feeler gauge, between adjusting plate **C** and stud **A.**
7. Tighten screw **B** to pinch tightness.
8. Loosen screw **D.**
9. Rotate hand wheel to bring needle bar to its lowest point.
10. Follow the same procedure used to set clearance with needle bar at top dead center to set a clearance of .005" between adjusting plate **C** and stud **A** with needle bar at bottom dead center.
11. Tighten screw **D** to pinch tightness.
12. Recheck clearances at both top and bottom dead center.
13. Securely tighten screws **B** and **D.**
14. Recheck clearances at both top and bottom dead center.

Check:

1. Select straight stitch, single pattern and observe needle bar while running machine. There must be no movement of the needle bar (jiggle).
2. If this condition exists, recheck and adjust, if necessary, needle bar recoil spring and needle bar clamp and guide stud adjusting plate.
3. Recheck for needle bar movement. If movement still exists, increase .005" adjusting plate tolerance until needle bar movement ceases.

NEEDLE BAR HIGH LIFT ADJUSTING BRACKET

Preparation:

1. Remove face plate and arm top cover.

Check:

1. Rotate hand wheel until needle bar is at its highest point.
2. Rock high lift bracket **A** front-to-back from the bottom.
3. Observe horizontal front-to-back movement at the top of the high lift bracket. There should be a horizontal movement of .001" to .035". NOTE: When moving high lift bracket forward, it must just come to rest against tripping lever **B.** Excessive pressure will result in movement of lever **B** and a slight opening of the needle bar latch **C.** If this occurs, a false measurement clearance will result.

Adjustment:

1. Rotate hand wheel until needle bar is at highest point.
2. Check that needle bar latch is fully engaged.
3. Loosen adjusting bracket clamping screw **D.**
4. Move adjusting bracket **E** backward or forward as required until a movement of .001" to .035" at the top of the high lift bracket is observed.
5. Tighten clamping screw **D** and recheck.

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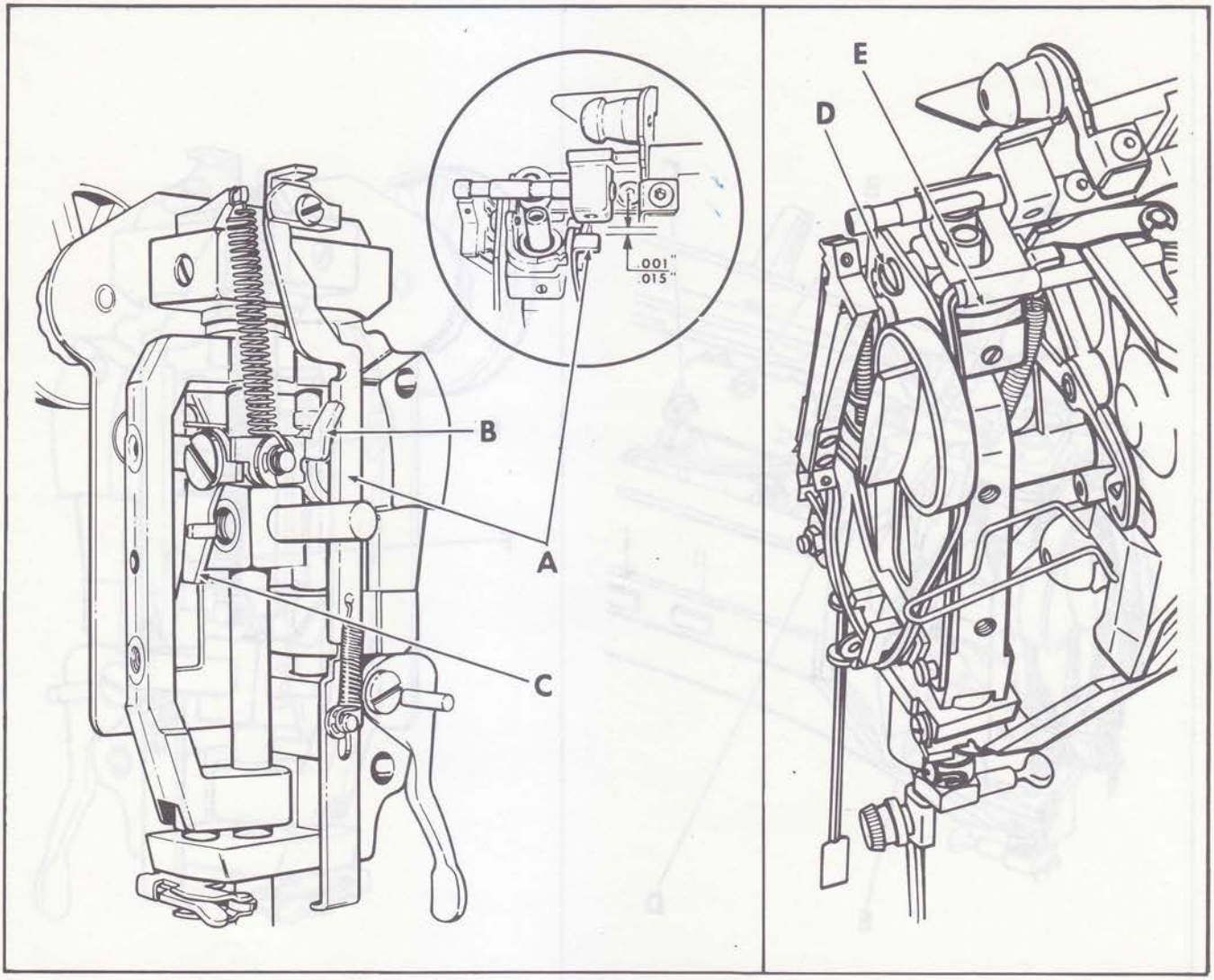
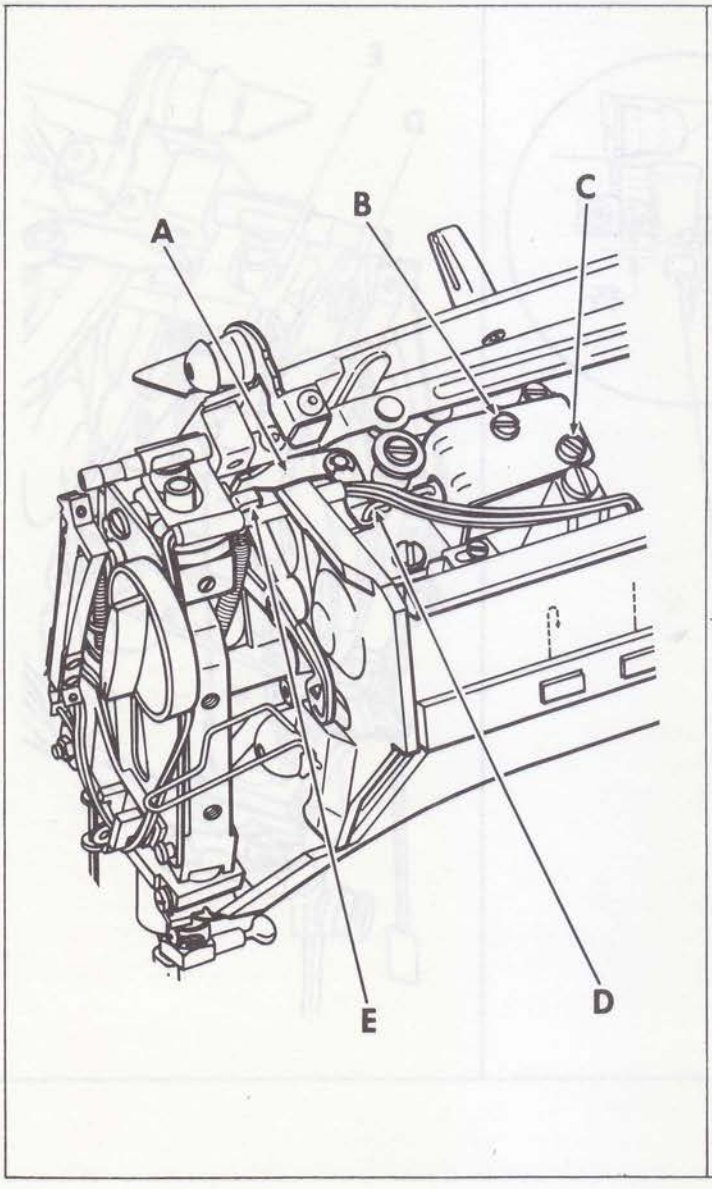
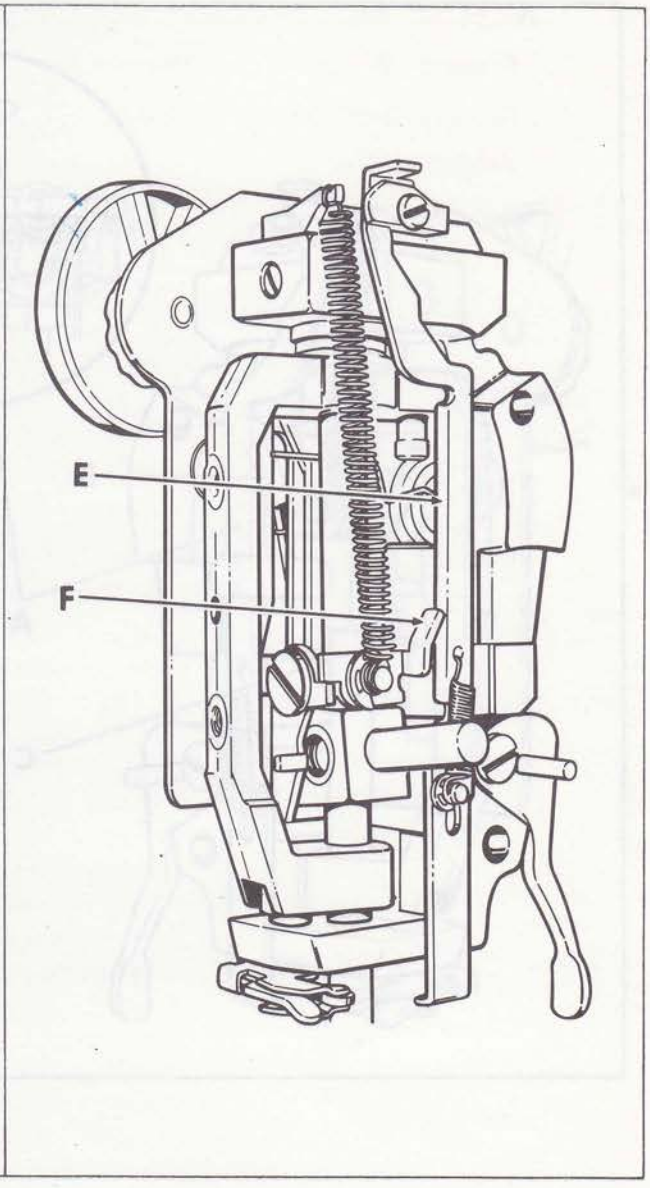

.001"
.015"
A
B
C
D
E





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NEEDLE BAR RELEASE SOLENOID

Preparation:

1. Remove face plate and arm top cover.

Machine Settings:

1. Pattern Selection: Maxi-Stretch

Adjustment:

1. Rotate hand wheel until needle bar comes to its lowest point and solenoid is energized. Be sure solenoid plunger is properly bottomed by pressing plunger to the right.
2. Loosen solenoid clamping screws **B** and **C.**
3. Move solenoid to the right until tripping lever **A** comes in contact with high lift bracket **E.** Continue moving solenoid to the right until high lift bracket just comes in contact with latch release lever **F.**
4. Tighten clamping screws **B** and **C.**
5. Check for proper action at very slow speed and at the top of the fast speed range.

Check:

1. Check presser bar for correct height.
2. Insert a size 14 needle in needle clamp.
3. Select straight stitch and cycle machine several times.
4. Raise presser foot, being sure presser foot sole plate is parallel to the bed of the machine, and turn hand wheel by hand until the tip of the needle, on its DOWNWARD stroke, is level with the underside of the presser foot sole plate.
5. Depress straight stitch button. If needle bar releases, solenoid setting is correct.
6. If needle bar does not release, press in lightly on end of solenoid plunger to ensure it is "bottomed". If needle bar does not release, slowly rotate hand wheel toward front of the machine. If needle bar does not move downward but releases just as the hand wheel is turned, the solenoid setting is correct.
7. If the needle bar still does not release, the solenoid setting is unacceptable and the solenoid must be move further to the right to cause earlier release.
8. Too early release is indicated by excessive noise and/or missed stitches in Maxi-stretch or Basting patterns. In this case, the solenoid must be moved to the left a sufficient amount to correct the condition. However, release must occur at least as low as the presser foot plate.

PRESSER BAR HEIGHT, ALIGNMENT, AND PRESSURE

Preparation:

1. Remove face plate.

Check:

1. Needle bar height.

Presser Bar Height Adjustment

Adjustment:

1. Reduce presser bar pressure to DARN.
2. Raise presser bar, turn hand wheel and check to make sure the back edge of the needle clamp just clears, but does not strike, the presser foot when the needle bar is all the way down. The upper line **C** on the needle bar must be in line with the bottom of the presser bar bushing.
3. Loosen hex screw **B** and adjust height of presser bar if necessary.
4. Tighten presser bar hex screw **B.** Lower presser foot on top of sheet of paper. With feed dog below needle plate, there should be a very light drag felt on the paper when it is pulled from side to side.

Presser Bar Alignment Adjustment

Adjustment:

1. Reduce presser bar pressure to DARN.
2. Loosen presser bar hex screw **B** leaving a light pinch on presser bar for control.
3. Align presser foot sides with feed slots in needle plate.
4. Securely fasten presser bar hex screw and return presser bar pressure to NORM.
5. Recheck presser bar height.

Presser Bar Pressure Adjustment

Adjustment:

1. Set pressure dial in DARN position.
2. Turn hand wheel to move feed dog below surface of needle plate.
3. Place sheet of paper under presser foot.
4. While pulling paper left-to-right, turn adjusting screw **A** to create a slight drag on the paper.
5. Set pressure dial in NORM position.
6. Run machine with paper under foot. If there is any deviation from straight feeding, check feed suspension, feed carrier and feed compensation link. See Alpha Feed System Adjustments.

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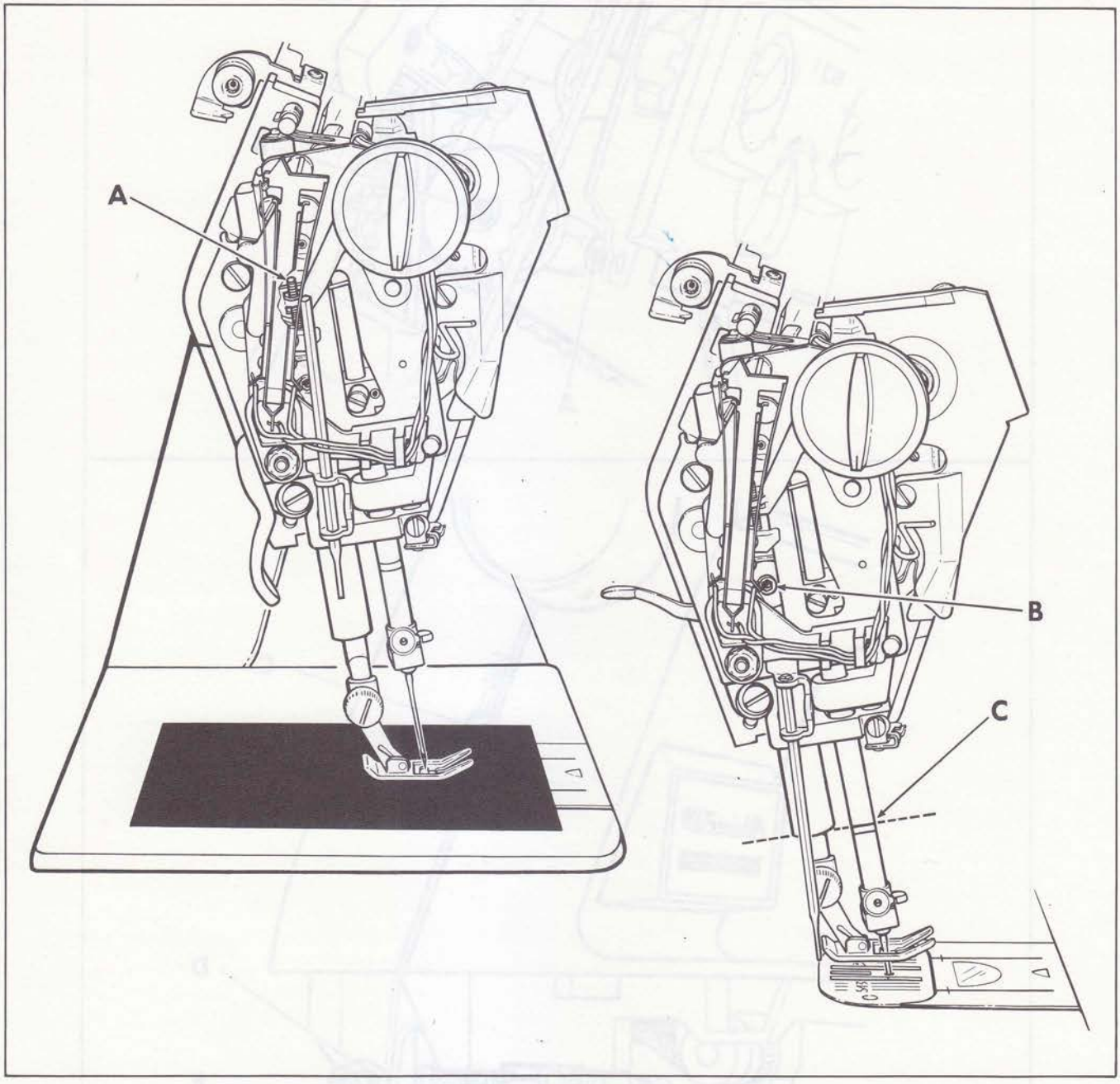
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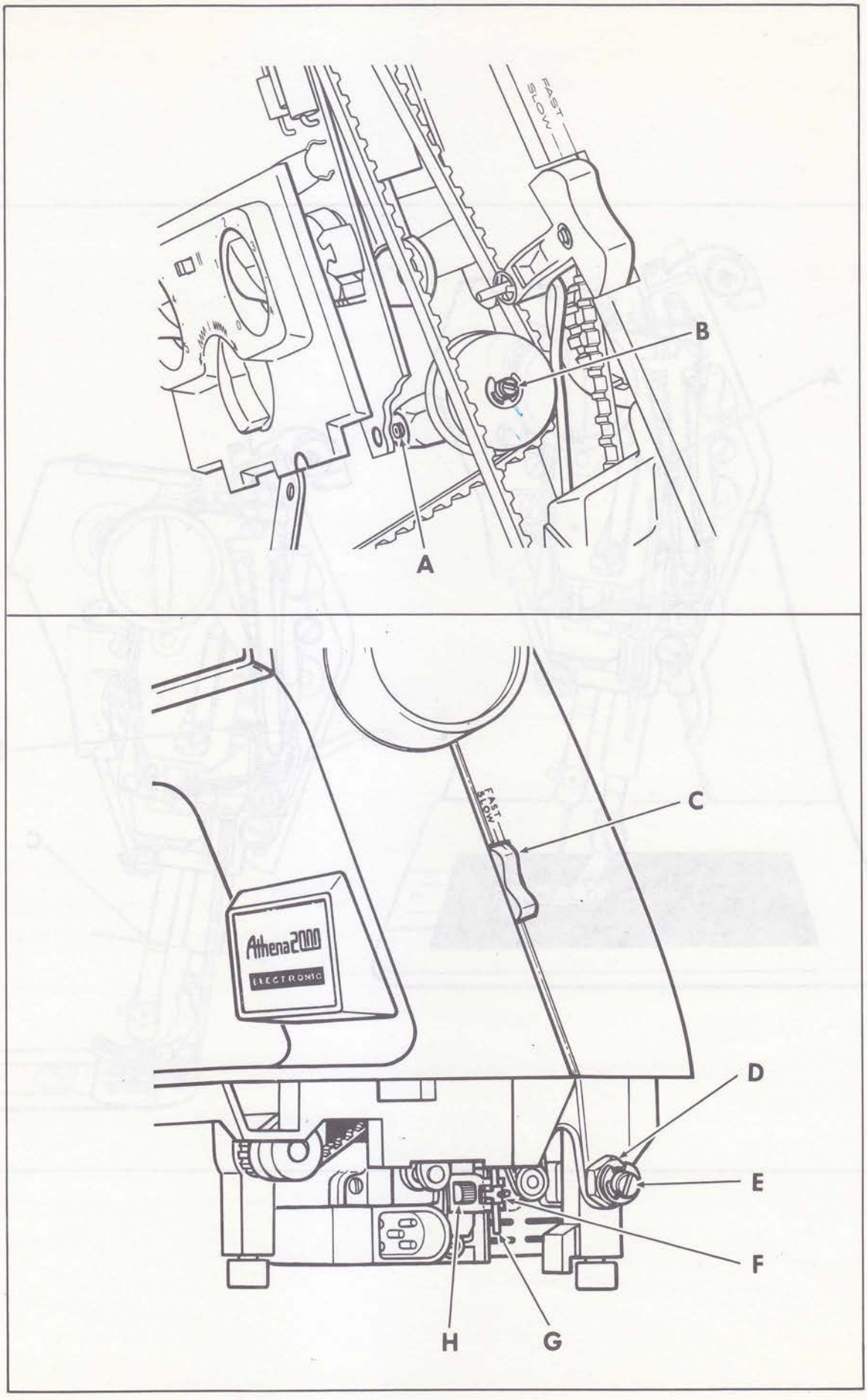

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TIMING BELT TENSION

Machine Settings:

1. Stitch Selection: Straight Stitch — Single Pattern
2. Speed Selector Switch: Fast

Preparation:

1. Remove front cover.
2. Remove needle.
3. Presser foot raised.

Adjustment:

1. Carefully loosen set screw **A** that holds idler pulley eccentric **B.** Maintain a pinch on screw **A** for control.
2. Run the machine at high speed and turn idler pulley eccentric **B** toward the rear of the machine (this will slow down the machine).
3. Slowly turn eccentric **B** toward the front of the machine to attain the highest speed. Hold eccentric in this position and tighten set screw **A.**
4. Check hook timing. Adjust, if necessary.

MOTOR BELT TENSION AND MOTOR SWITCH

Machine Settings:

1. Stitch Selection: Straight Stitch — Single Pattern
2. Speed Selector Switch: Fast

Preparation:

1. Remove needle.
2. Presser foot raised.
3. Remove bottom cover.
4. Replace bed cushions.

Adjustment:

1. Loosen lock nut **D** on motor belt tension adjusting eccentric **E.**
2. Turn eccentric **E** left or right to tighten belt (this will slow down the machine).
3. Turn eccentric **E** left or right to loosen belt until machine attains highest speed. Then tighten lock nut **D.**
4. Set motor switch **H** to center (slow) position.
5. Verify correct position of rocker switch **C.** Vertical line on switch should be even with casting.
6. Compress the prongs on retaining clip **F** and move connecting rod **G** up or down as required.

NEEDLE CROSSOVER - TIMING THE SHUNT

Function: The arm shaft shunt **A,** acts as a timing device so that needle crossover and feed motion occur at the correct time. When needle motion is timed correctly, the feed motion is automatically correct.

Machine Settings:

1. Stitch Selection: Zig-Zag

Preparation:

1. Remove front cover.
2. Presser foot raised.

Check:

1. Check for correct needle bar height.
2. Check for correct presser bar height.
3. Rotate hand wheel slowly. Needle crossover, illustration **D,** should occur while the point of the needle is within the thickness of the sole plate of a raised presser foot.

Adjustment:

1. Loosen set screw **B.**
2. Retard needle crossover by rotating shunt **A** counterclockwise on the arm shaft, with reference to the head end.
3. Advance needle crossover by rotating shunt **A** clockwise on the arm shaft, with reference to the head end.
4. Tighten set screw **B,** being careful not to disturb the shunt location laterally. There should be .040" ± .015" clearance between the face of the shunt and the magnet, illustration **C.**
5. Recheck needle crossover and readjust if necessary.

NOTE: Should set screw **B** be lost or mislaid, replace only with the original part number. This screw must be of a non-magnetic material and replacement with a ferrous-type screw will cause machine malfunction.

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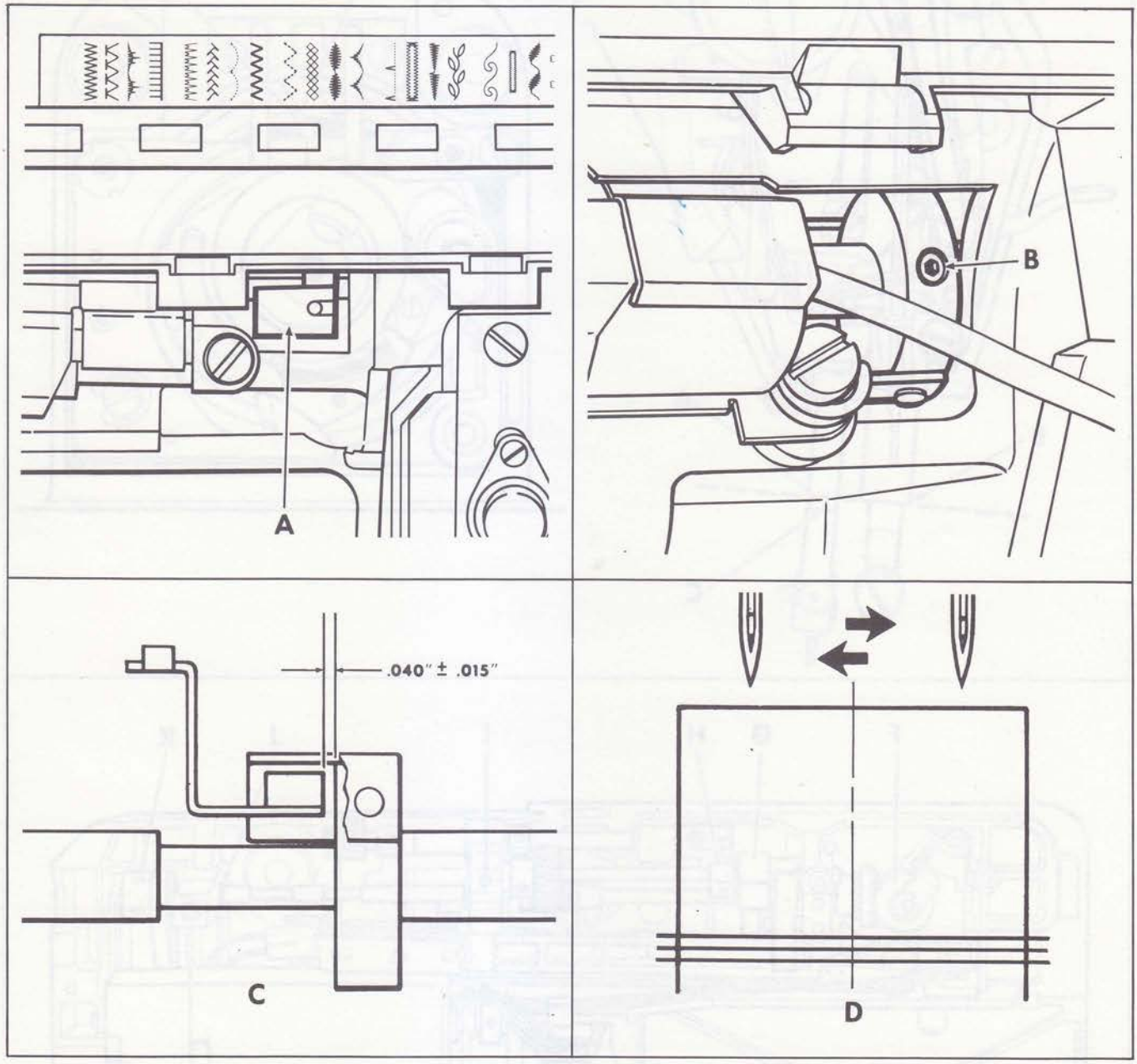
A
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C
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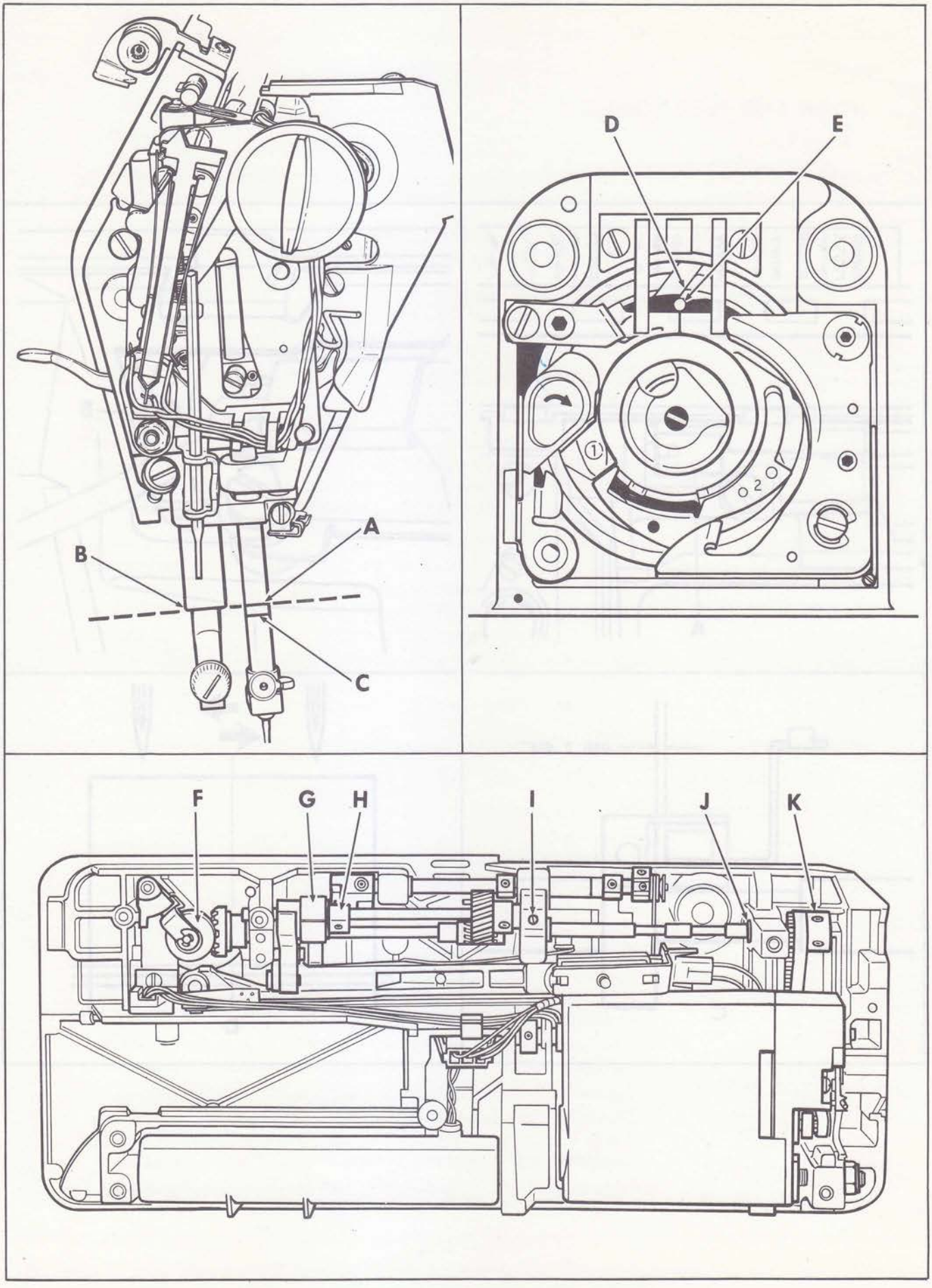

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HOOK AND FEED TIMING

Hook Timing

Before hook timing is attempted, timing belt tension must be correct and set screws tight in the arm shaft driving sprocket. Hook-to-needle relationship must be correct.

Machine Settings:

1. Stitch Selection: Straight Stitch
2. Needle or Plug Size: No. 18

Preparation:

1. Remove bottom cover.
2. Remove needle plate and presser foot.

Check:

1. Check hook gear mesh. For adjustments see Replacement of Hook.
2. Turn hand wheel toward front of machine until needle bar is in its lowest position.
3. Using a straight edge, observe position of needle bar upper timing mark **A** in relation to presser bar bushing **B.** Turn hand wheel toward front of machine until needle bar lower timing mark **C** is in the same position as the upper timing mark was in relation to presser bar bushing **B.** The point of hook **D** should be at center of needle **E.**

Adjustment:

1. Loosen the two set screws in hook drive shaft sprocket **K.**
2. While maintaining position of needle bar lower timing mark in relation to presser bar bushing, turn vertical gear **F** at hook end of shaft until point of hook is within width of needle blade.
3. Tighten both set screws of sprocket **K,** making certain that the sprocket is clear of bushing **J** (approximately .010"-020") without binding.
4. Check feed timing and adjust if necessary.

Feed Timing

Machine Settings:

1. Stitch Selection: Straight Stitch

Adjustment:

1. Verify hook timing before attempting any change in feed timing.
2. Feed timing is checked by means of timing lines on needle bar — the same as hook timing.
3. Loosen both set screws in feed lifting cam (eccentric) **H.**
4. Turn hand wheel toward front of machine until needle bar is in its lowest position. Observe position of needle bar upper timing mark **A** in relation to presser bar bushing **B** using a straight edge.
5. Turn hand wheel toward front of machine until needle bar lower timing mark **C** is in the same position as the upper timing mark was in relation to presser bar bushing **B.**
6. Turn feed lifting cam **H** until timing mark on cam is aligned with timing mark on feed regulator slide block drive connection **G.**
7. Tighten both set screws in feed lifting cam **H** and recheck.
8. Check for binding between feed drive eccentric and connecting link **G.** If necessary, loosen set screw **I** and move bushing with feed drive shaft left or right to eliminate binding. Tighten set screw.
9. Perform bind test for feed mechanism and readjust if necessary.

HOOK-TO-NEEDLE RELATIONSHIP

Machine Settings:

1. Stitch Selection: Zig-Zag
2. Needle Size: No. 18

Preparation:

1. Remove bottom cover.
2. Remove presser foot.
3. Remove needle plate.
4. Remove bobbin.

Check:

1. Lost motion in the needle bar latch and take-up lever connecting link.
2. Needle bar play front-to-rear.
3. Needle location in straight-stitch (round hole) needle plate. Front-to-back and left-to-right.
4. Hook timing.

Adjustment:

1. Turn hand wheel toward you until the point of the hook is directly behind the No. 18 needle **A,** when the needle is down and in the right hand position of the zig-zag stitch.
2. Loosen set screw **C** that holds eccentric bushing **B.**
3. Insert small screwdriver through access hole in hook into slot in bushing. Starting with bushing slot at the 6:00 o'clock position, turn eccentric bushing **B** counterclockwise (toward 3:00 o'clock position) to decrease clearance, or clockwise (toward 9:00 o'clock position) to increase clearance, until hook lightly touches needle. Tighten eccentric bushing set screw **C.**
4. Turn hand wheel to bring the needle down in the left hand position of the zig-zag stitch. There should be no more than .005" clearance between the point of the hook and the needle.
5. Select straight stitch.
6. There should be no interference between the point of the hook and the needle in straight stitch.
7. Reset gear mesh. For adjustment see Replacement of Hook.

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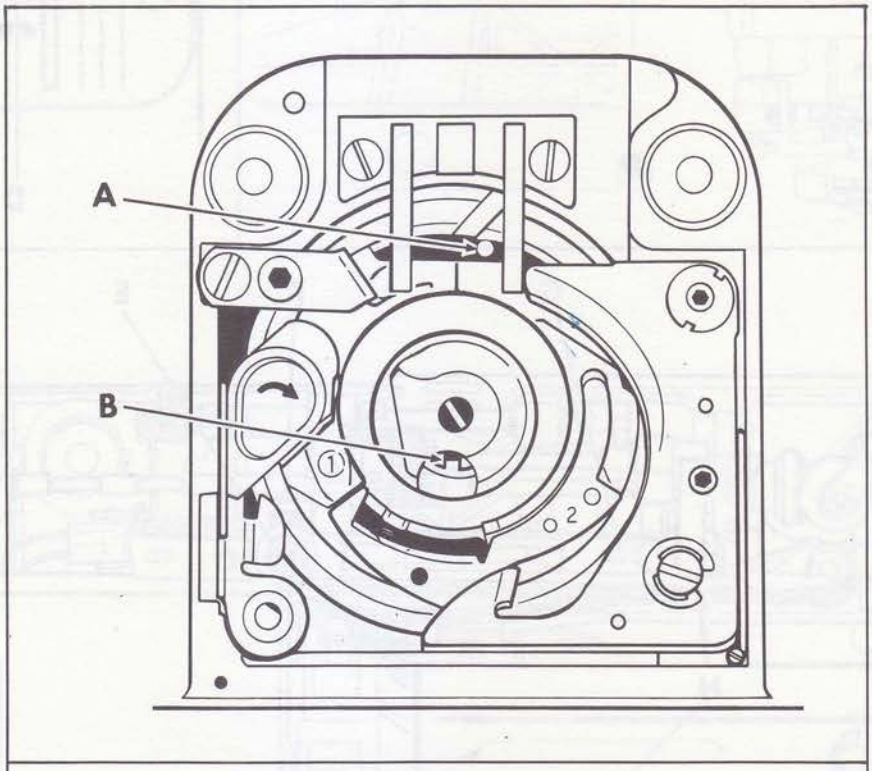
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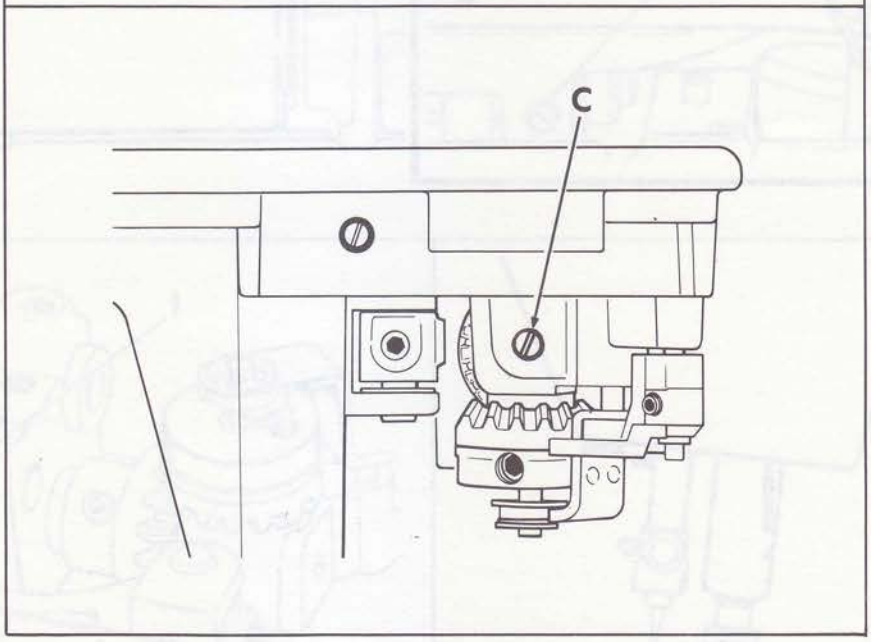
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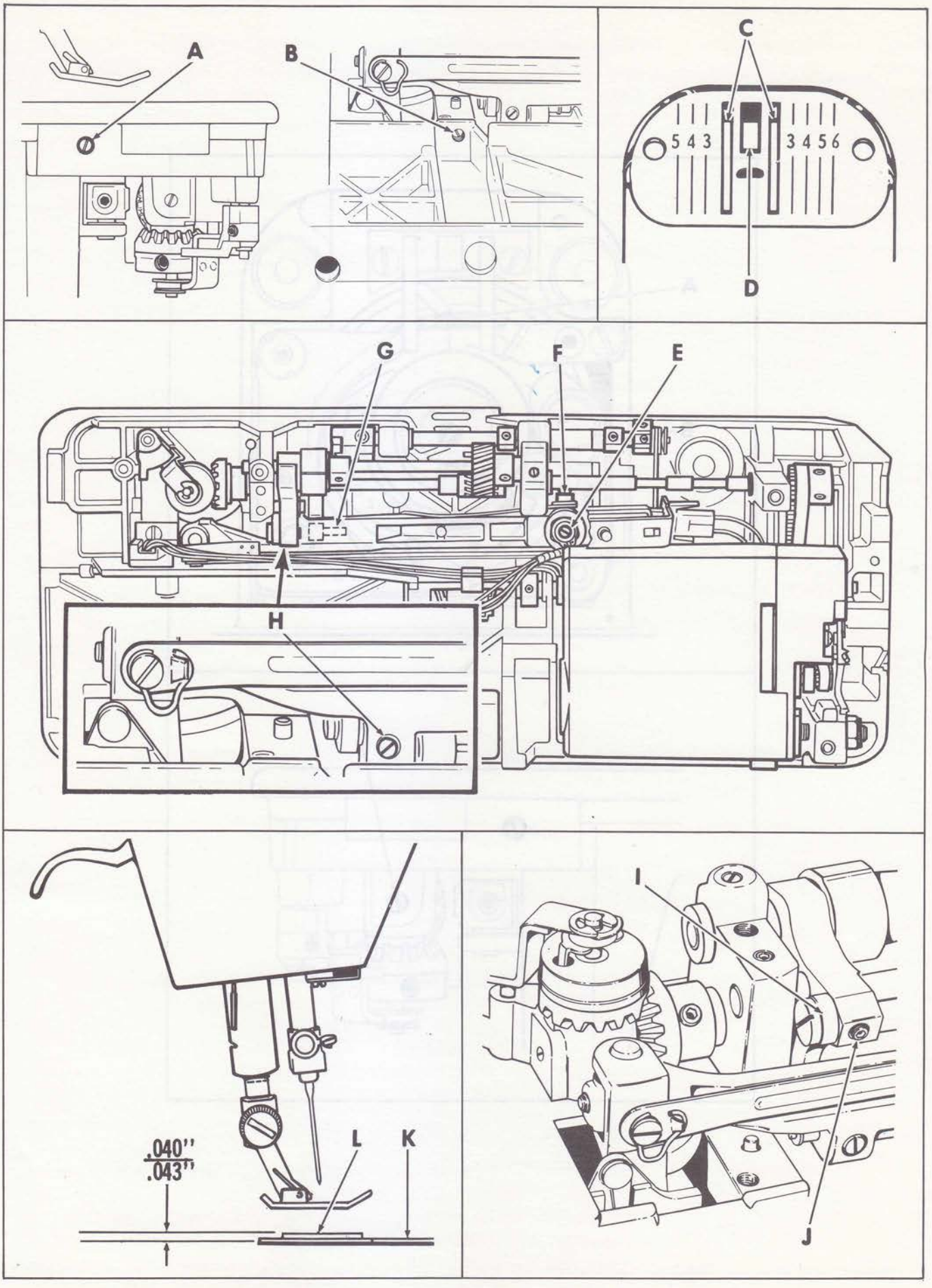

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ALPHA FEED

Preparation: Remove bottom cover.

Check: Before making adjustments, check the following Alpha Feed bearing points:

1. Pivot bearings for looseness or binding.
2. Presence of pulse movement of feed bar on hinge stud.
3. Feed carrier — absence of vertical looseness or binding.
4. Feed slide block and feed regulator — absence of looseness or binding.
5. Feed connecting links — minimum looseness.
6. Feed dog legs are parallel both horizontally and vertically.
7. Feed dog legs are aligned within needle plate slots.

NEEDLE PLATE MAGNET HEIGHT

Adjustment:

1. Turn hand wheel to bring feed dog to its lowest point, to prevent possible interference.
2. Loosen needle plate magnet pin set screws **A** and **B.**
3. Seat needle plate firmly against bed casting by holding fingers over needle plate and needle plate magnet pins.
4. Tighten set screws **A** and **B.**
5. Check for any tilting movement of needle plate, and readjust if necessary.

FEED DOG CENTRALIZING

Machine Settings:

1. Stitch Selection: Straight Stitch

Adjustment:

1. Turn hand wheel toward front of machine until feed dog **C** is at its highest point.
2. Loosen set screw **E** that holds feed bar pivot hinge eccentric **F.**
3. Turn feed bar pivot hinge eccentric **F** with 5/16" wrench until feed dog **C** is centrally located in needle plate slots (left to right).
4. Tighten set screw **E.**
5. Check for binding or looseness at feed connecting link and eccentric.
6. Check for correct positioning of feed regulator.

FEED DOG THROW

Machine Settings:

1. Stitch Selection: Straight Stitch
2. Stitch Length: Maximum

Adjustment:

1. Turn hand wheel toward front of machine until center bar of feed dog is in its most forward position in center slot of needle plate.
2. Loosen set screw **H** holding feed bar connection eccentric **G** and turn eccentric **G** until center bar **D** of feed dog is as close as possible to needle plate without striking it.
3. Tighten set screw **H.**

FEED DOG HEIGHT

Machine Settings:

1. Stitch Selection: Straight Stitch
2. Stitch Length: Maximum

Adjustment:

1. Turn hand wheel toward front of machine until feed dog **L** is at its highest point.
2. Loosen set screw **J** holding feed lifting eccentric **I** and turn feed lifting eccentric **I** until top of feed dog **L** is .040" to .043" above needle plate **K.** Tighten set screw **J.**

NOTE: After any adjustment to the Alpha Feed, perform bind test for the feed mechanism.

ALPHA FEED ZEROING

Before any adjustments are attempted to zero the Alpha feed, the following interlocking adjustments must be verified.

1. Needle plate magnet height.
2. Feed dog centralization, throw and height.
3. Regulator return spring.
4. Pivot bearings for looseness or tightness.
5. Lateral position of feed regulator.
6. Tightness of feed regulator set screw.
7. Feed regulator shaft end play.

Machine Settings:

1. Stitch Selection: Straight Stitch, Single Pattern.
2. Speed Selection: Fast.

Check:

1. Place a piece of ruled paper under the presser foot.
2. Run machine at high speed.
3. There should be no reverse feed.

NOTE: On occasion, there may be a machine where absolute zero feed may be difficult to achieve. In such cases, forward paper movement must not exceed 1/4 inch in fifteen seconds.

Preparation:

1. Remove arm top cover, front cover and bottom cover.
2. Verify linear feed motor offset and scale voltages at test point 9 on the digital board.
3. Verify linear feed motor feed position signal (feed back voltage) at test point 3 on the servo board.
4. Verify linear feed motor feed correction signal at test point 8 on the servo board.
5. Verify zero location of linear feed motor bobbin.

Adjustment:

1. Place a piece of ruled paper under the presser foot.
2. Loosen set screw **A.**
3. While running the machine at high speed, turn feed regulator eccentric **B** clockwise or counterclockwise to obtain zero feed. (No movement of the paper.) The throw of eccentric **B** must be toward the bottom of the machine.
4. Tighten set screw **A** and recheck.
5. Sew several buttonholes with balance control dial in neutral (point of dial on center mark). Check that both legs of the buttonhole contain an equal number of stitches (balanced).
6. Readjust eccentric **B** to satisfy the condition in step 5.

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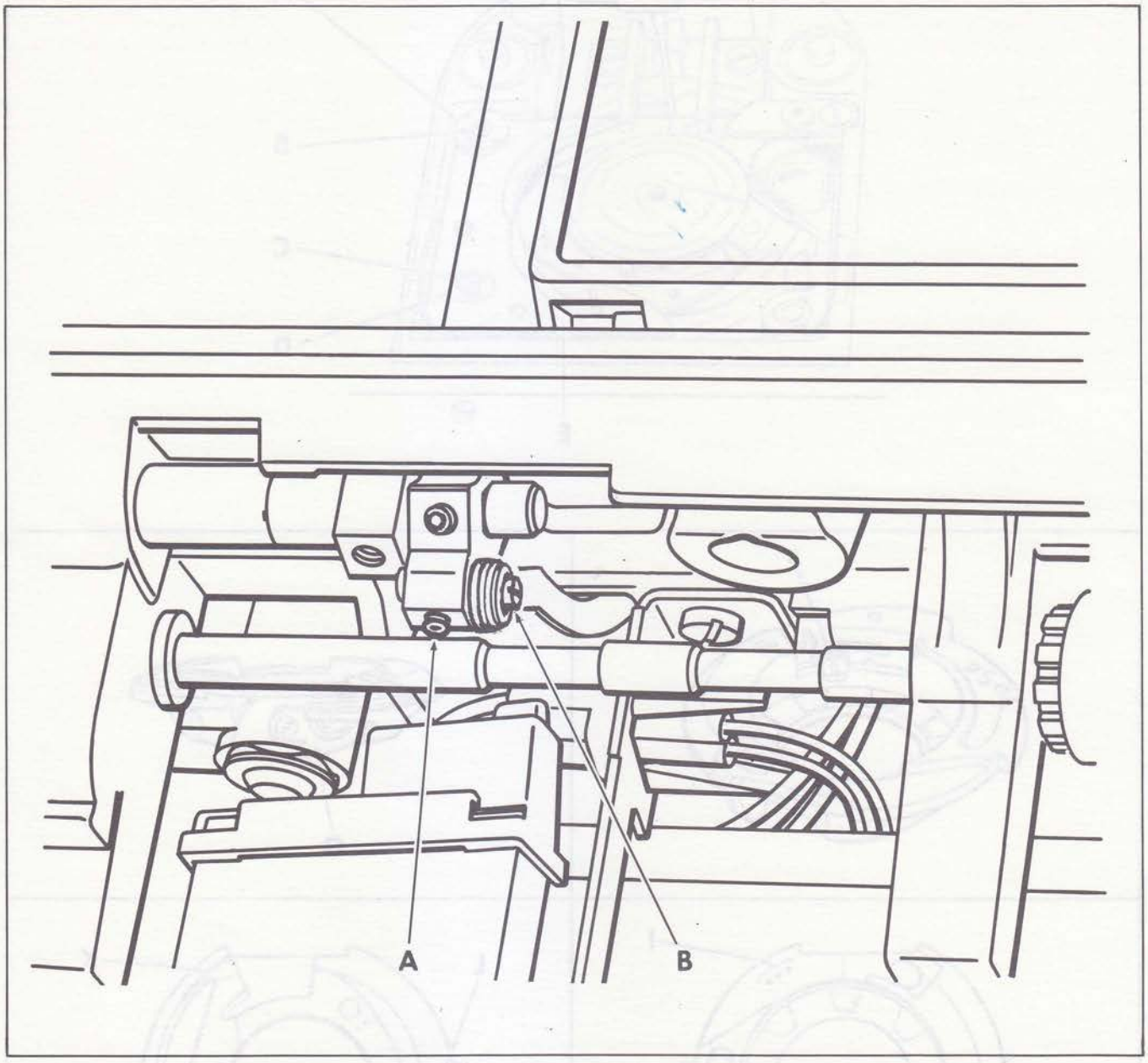
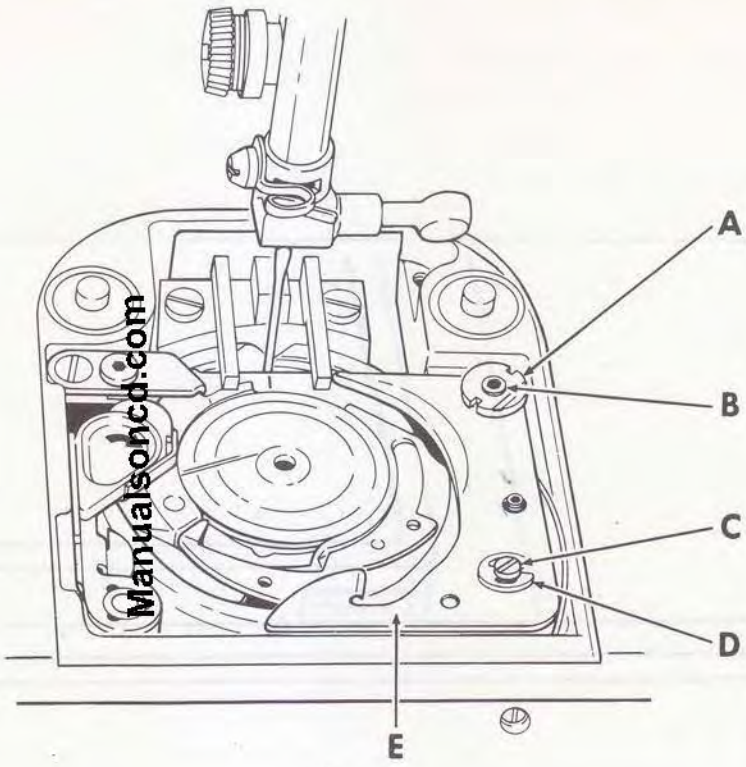

A
B



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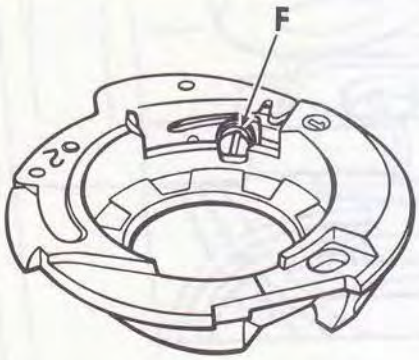

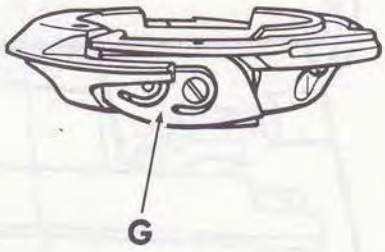

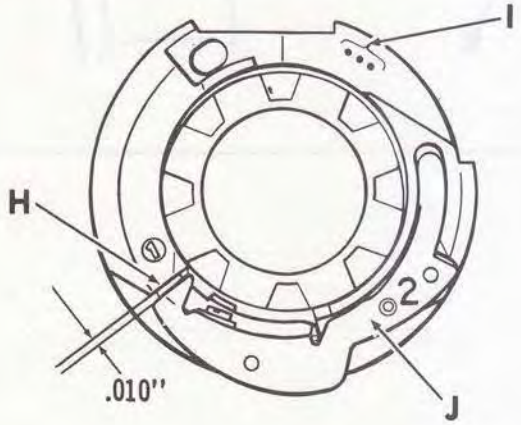

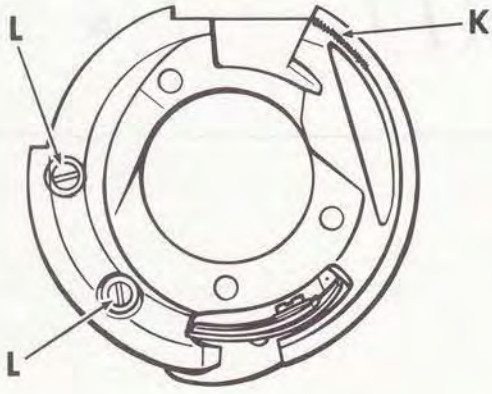

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BOBBIN CASE THREAD CLEARANCE

BOBBIN CASE INSPECTION AND PRELIMINARY ADJUSTMENTS

Preparation:

1. Remove bottom cover.
2. Remove needle plate.
3. Remove bed slide.

Removal:

1. To remove the bobbin case without affecting thread clearance, hold rear elevator screw **B** in position with hex-head wrench and do not turn screw. Remove lock nut **A.**

NOTE: DO NOT REMOVE OR TURN ANY OTHER SCREWS IN THE CENTAUR HOOK AREA.

2. Remove "E" ring **D** from eccentric adjusting stud **C,** and remove bobbin case position plate **E.**
3. Remove bobbin case.

Bobbin case inspection. Check bobbin case for -

1. Pit marks on top shelf of bobbin case **I.**
2. Grooving at hook entry area (loop separator point **K**) on underside.
3. Distorted tension springs **G.**
4. Insufficient clearance between tension bracket **J** and vertical wall **H.**
5. Tightness of tension bracket screw or screws **L.**

Causes of bobbin case damage -

1. Damage to the bobbin case is caused by the hook when the bobbin case migrates into the hook path. Bobbin case migration is caused by thread build-up, resulting from improper threading or winding, and the bobbin case position plate lifting and permitting the bobbin case to move into the hook path.
2. Damage to tension spring **G** is caused by careless removal of loaded bobbin from bobbin case.

Operating quality tests -

1. Thread should enter tension springs smoothly without snagging.
2. With bobbin case correctly mounted in machine, test for ability to thread bobbin case from "1" to "2" using a loaded bobbin.
3. Test for uniformity of tension, with bobbin case in machine, by drawing thread slowly through tension. There should be no change in "feel" of pull.
4. Test for cogging of bobbin, when bobbin case is in machine, by drawing thread through tension from a bobbin loaded with only 2 or 3 yards of thread.
5. Check all areas of bobbin case, where thread loop passes, to be sure there are no sharp corners to snag the thread loop.
6. Check to be sure a rubber friction washer is on tension adjustment screw **F.**
7. Check for sufficient clearance, .010", between tension bracket **J** and vertical wall **H** of bobbin case.

Mandatory replacement of damaged parts -

If damage is observed or operating quality is incorrect, it is not only a matter of good service but it is MANDATORY that both the bobbin case and position plate be replaced.

Position Plate Cushion Spring Adjustment:

1. Check for clearance of .020"-.025" between vertical edge of position plate **H** and cushion spring **J.**
2. Loosen clamping screw **M** that holds cushion spring **J** and move spring until a clearance of .020"-.025" is obtained.
3. Tighten clamping screw **M** and recheck clearance. Point **K** of spring must not overlap edge **L** of position plate. It should be flush to .015" below.

Replacement of Bobbin Case:

Replace bobbin case on left side of hook race so that the vertical edge of the position finger retains the bobbin case.

Bobbin Case Position Plate Replacement:

1. Seat bobbin case position plate **H** over rear elevator screw **D** and adjusting stud **E.** Replace "E" ring **F.**
2. Thread lock nut **C** on position plate rear elevator screw **D.**
3. Hold position plate rear elevator screw **D** with hex wrench and tighten lock nut **C** to pinch tightness.

Bobbin Case Radial Alignment with Needle:

1. Select straight stitch.
2. Insert a Size 18 needle into needle clamp and turn hand wheel toward the front of the machine until the needle is at the lowest position. In this position, score mark **B** on bobbin case should be in line with needle **A.** If score mark **B** is to the left or the right of the needle blade, make the adjustment described in the steps that follow.
3. Loosen set screw **G** that holds eccentric adjusting stud **E.**
4. Align score mark **B** on bobbin case with needle, and turn eccentric adjusting stud **E** until position plate cushion spring **J** is touching heel **I** of bobbin case.
5. Press down lightly on stud **E** and tighten screw **G.**
6. Tighten lock nut **C.**

BOBBIN WINDING ADJUSTMENTS

Preparation:

1. Remove bottom cover.
2. Remove needle plate.
3. Remove bed slide.

Adjustment:

Actuating Lever Radial Position and Bobbin Driver Height Setting -

1. Remove bobbin **N** from bobbin case.
2. Hold actuating lever **Q** in sew position; loosen two hex head screws **V** in bobbin driver lifting cam **T** (make sure that bobbin driver lifting cam is in sew position).
3. Move actuating lever **Q** until winding guide **S** straddles outer edge **R** of bobbin case.
4. While holding actuating lever **Q** down and in step 2 position, slide lifting cam **T** up or down on actuating lever shaft **W** until bobbin driver **U** is .002" to .008" below hook (pull-off) surface **X.**
5. Tighten both hex head screws **V** and recheck.
6. Replace bobbin **N** in bobbin case.

Actuating Lever Height Setting -

1. Place actuating lever **Q** in wind position.
2. Loosen hex head screw **P** in collar of actuating lever **Q.**
3. Raise actuating lever **Q** and place a .008" to .012" shim **O** between underside of lever **Q** and top surface of bobbin **N.**
4. Move actuating lever **Q** down until it rests on shim **O,** tighten hex head screw **P** and remove shim.

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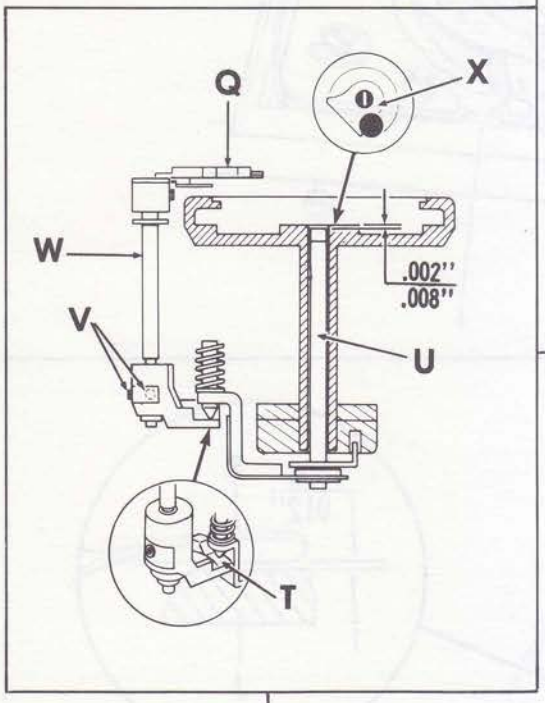
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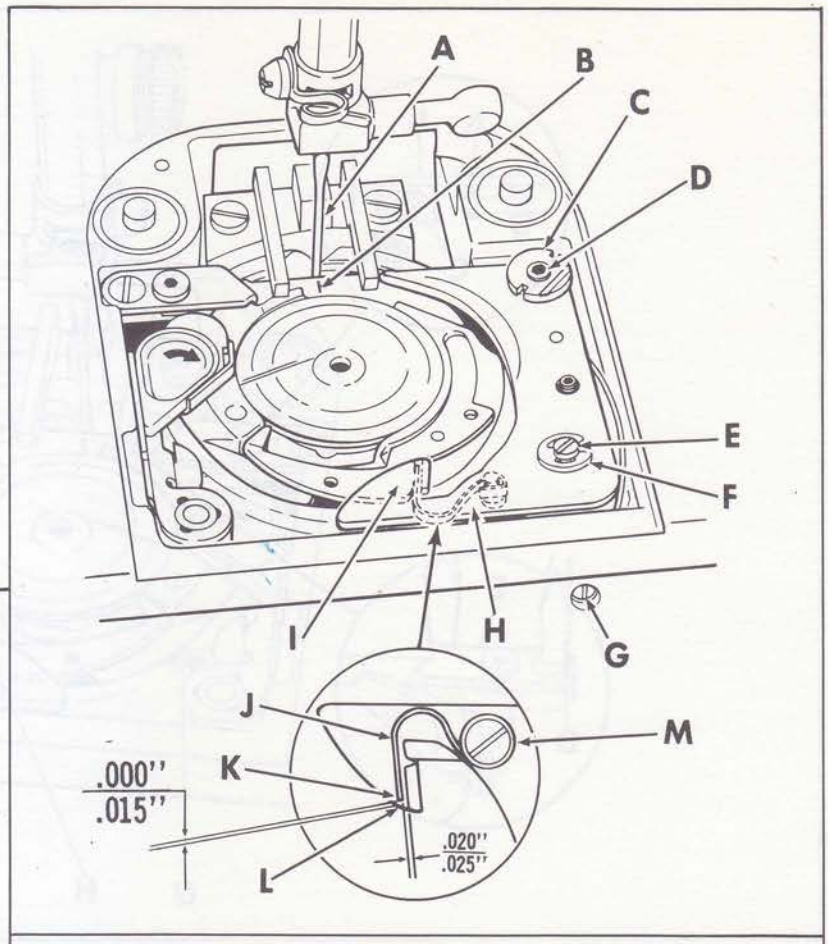
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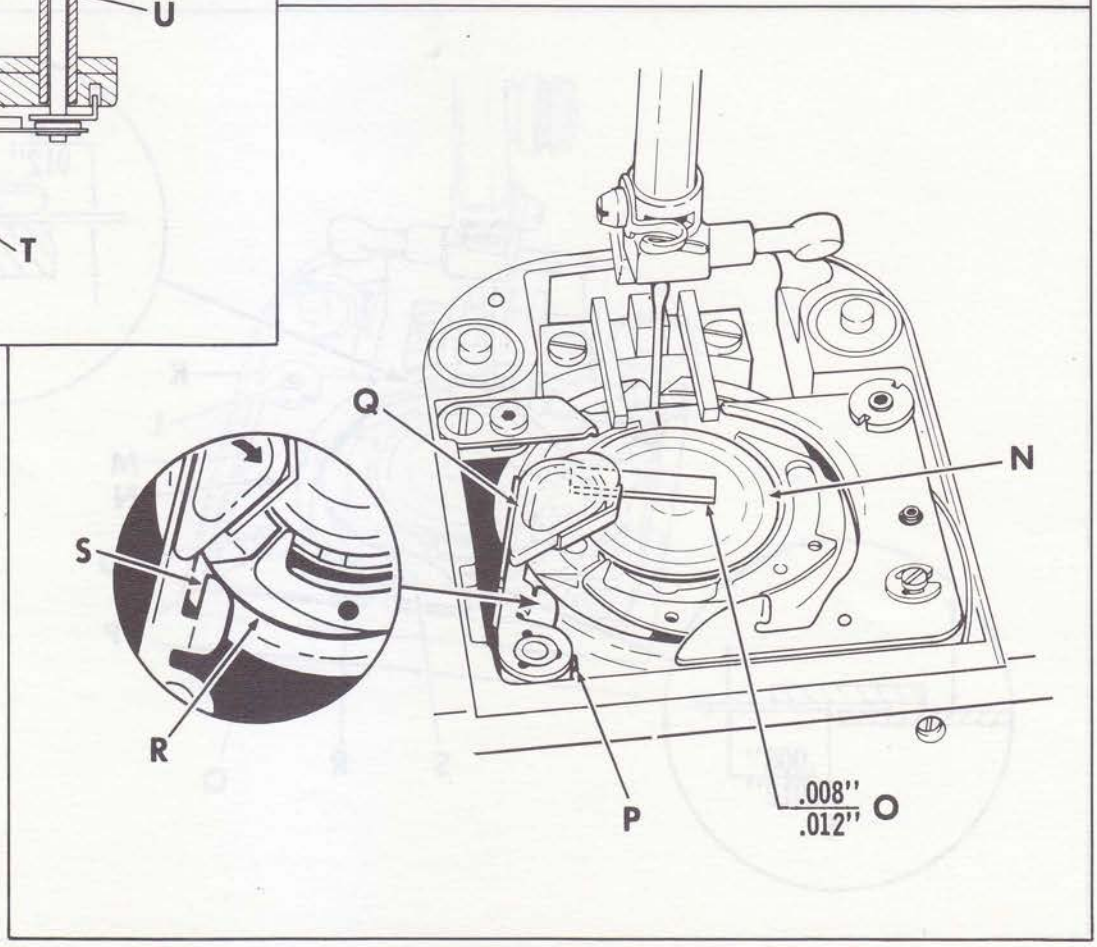
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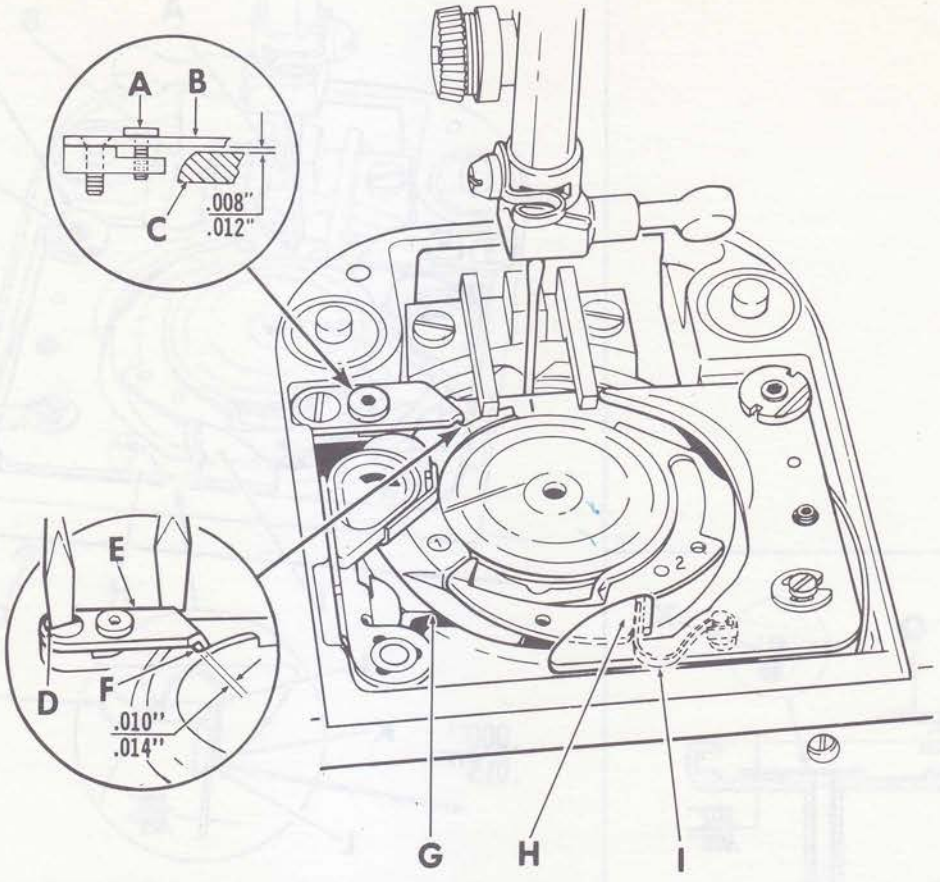

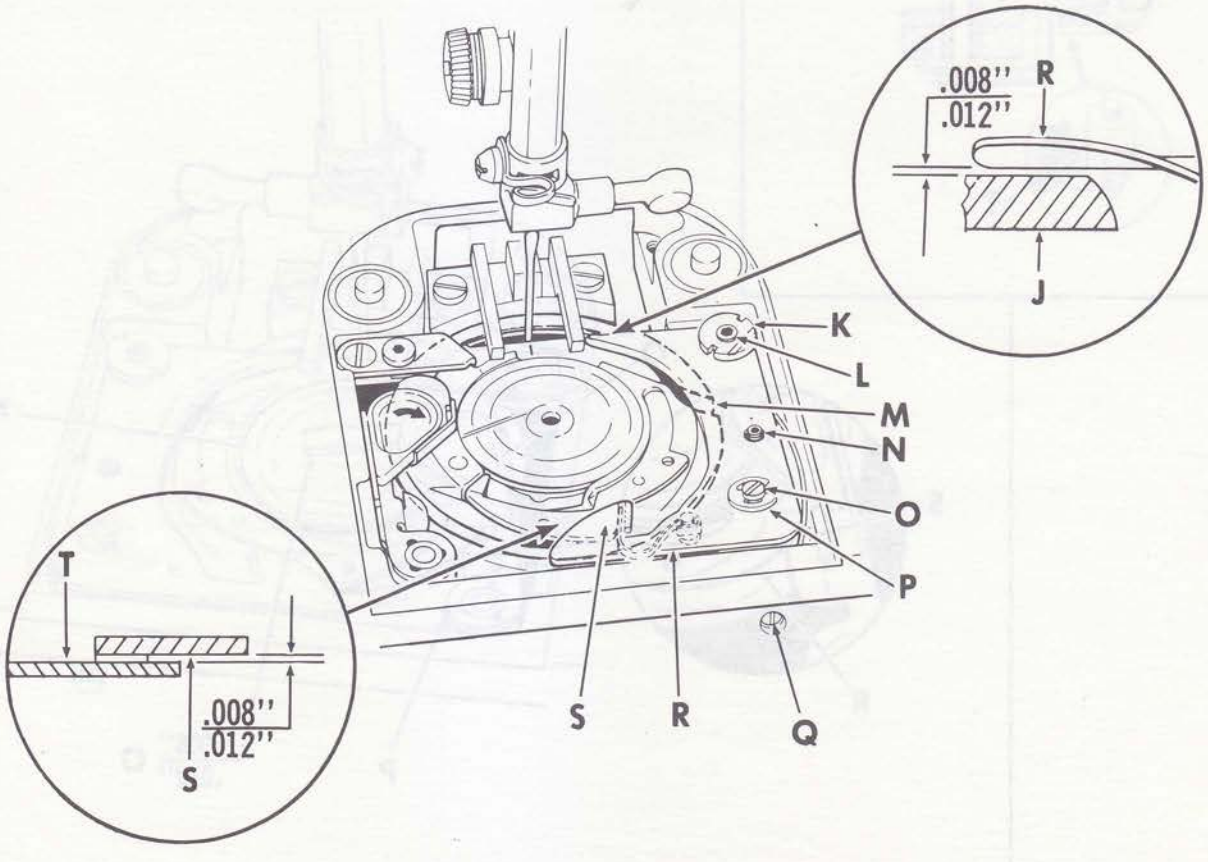

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POSITION FINGER AND BOBBIN CASE POSITION PLATE ADJUSTMENTS

Position Finger Height Setting -

Caution: At this time do not loosen slotted screw **D** (left hand thread).

Check: Check for a clearance of .008" to .012" between the top surface of bobbin case **C** and the underside of position finger **B.**

Adjustment: Set hook point to 7:00 - 9:00 o'clock position. Turn elevator screw **A** with a 1/16" Allen hex wrench until a clearance of .008" to .012" is obtained between the top surface of bobbin case **C** and the underside of position finger **B.**

Position Finger Radial Setting -

Check: With heel **H** of bobbin case resting against position plate cushion spring **I,** check for a clearance of .010" to .014" between the vertical edge **F** of the bobbin case wall and the vertical edge of position finger **E.**

Adjustment:

1. Set hook point **G** to 7:00 - 9:00 o'clock position.
2. Turn slotted, left hand thread, screw **D** clockwise to loosen.
3. Adjust position finger **E** for clearance of .010" to .014" between the vertical edge **F** of the bobbin case wall and the vertical edge of the position finger **E.**
4. Securely tighten slotted screw **D** (turn counterclockwise).

NOTE: Place the blade of a small screwdriver between the back of position finger **E** and the casting to hold position finger **E** in place while tightening slotted screw **D.** Recheck vertical clearance after tightening screw **D.**

Bobbin Case Position Plate Height -

Adjustment:

1. Loosen eccentric adjusting stud set screw **Q.**
2. Loosen lock nut **K** on rear elevator screw **L.**
3. Set hook point **M** to 3:00 o'clock position.
4. Set height of position plate at feed dog end to .008" to .012" clearance between position plate **R** and bobbin case **J.** Use rear elevator screw **L** to adjust the height. Clearance must be checked with lock nut **K** firmly secured.
5. Set height of position plate **R** at cushion spring end for clearance of .008" to .012" between underside **S,** of position plate **R** and top of bobbin case tension bracket **T.**
6. Use center elevator screw **N** to adjust the height.
7. Press lightly against top of eccentric stud **O** to seat retaining "E" ring **P** on position plate **R.** Be very careful not to depress the position plate at heel **S.** When the clearances are correct, tighten set screw **Q** to secure eccentric stud **O.**
8. Recheck radial position of bobbin case and reset if necessary.
9. Recheck both front and rear vertical clearances and reset if necessary.

TENSION MODULE

Preparation: 1. Remove face plate and arm top cover.

DIAL TENSION

Before attempting to make any corrective changes in tension, make sure tension release is working correctly.

If between "0" and "1" there is no appreciable change in tension, turn dial from "0" to "9" and note at what numeral tension begins to increase, and make adjustments as follows -

If tension does not appear before "4" or "5":

1. Return dial to "1".
2. Loosen nut **A** and turn tension regulating slide adjusting screw **B** clockwise, until 15 to 30 grams of tension is felt at this point.
3. Hold adjusting screw **B** and tighten nut **A.**

If tension at "9" seems to be below 490 grams:

1. Remove front cover.
2. Lower light fixture and remove light shield to gain access to screw **C.**
3. Turn tension screw **C** to achieve the minimum tension of 490 grams.
4. Recheck setting at tension dial setting of "1".

THREAD TAKE-UP SPRING

To set take-up spring tension:

1. Remove screw **D.**
2. Remove cap **E.**
3. Remove take-up spring **F** from spring position collar **G.**
4. Replace take-up spring **F** on position collar **G** with inside tail of spring into groove of position collar at approximately 8:00 - 8:30 clock-hand position.
5. Replace cap **E** and screw **D;** do not tighten screw **D** until stroke of take-up spring has been set.

To set stroke of take-up spring:

1. Select straight stitch.
2. Thread machine and place a piece of fabric under the presser foot.
3. Sew several inches and set tension to produce a balanced stitch.
4. Turn hand wheel toward front of machine.
5. After the needle point has penetrated approximately 1/16 inch into the fabric, the take-up spring should come to rest. Turn cap **E** to make this adjustment.
6. Tighten screw **D.**

TENSION RELEASE

To set tension release:

1. Turn tension dial to "9".
2. Raise presser bar.
3. Loosen screw **I** and move adjusting plate **J** to the left, until it pushes tension regulating slide **H** and unloads tension on pull-pin **K.**
4. Tighten screw **I.**
5. Check for clearance between regulating slide and adjusting plate throughout full range of tension dial settings. Tension must not release when presser bar is down.

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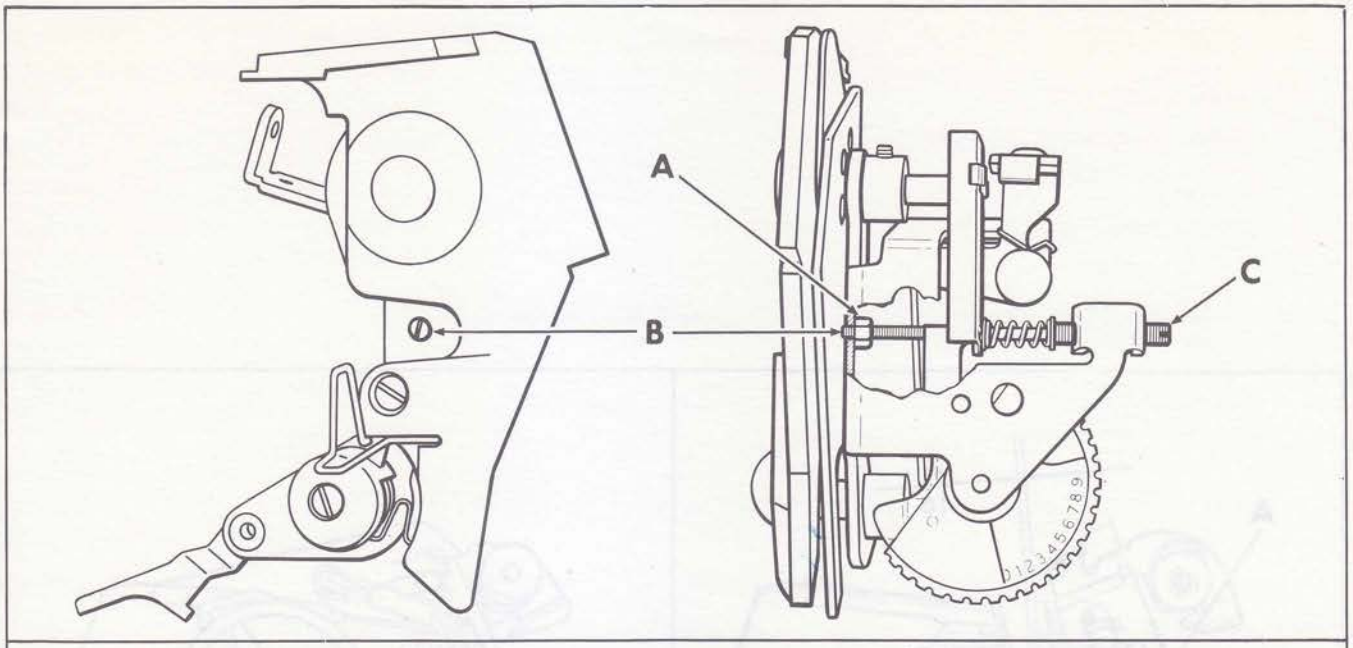
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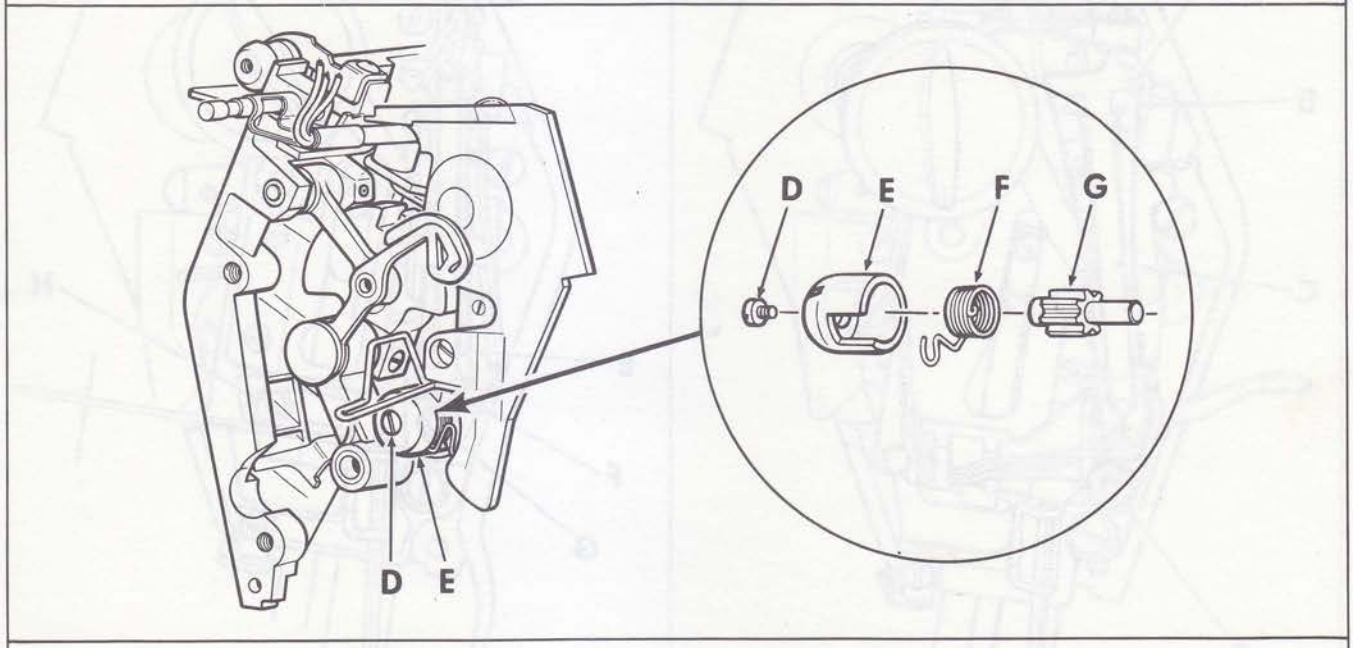
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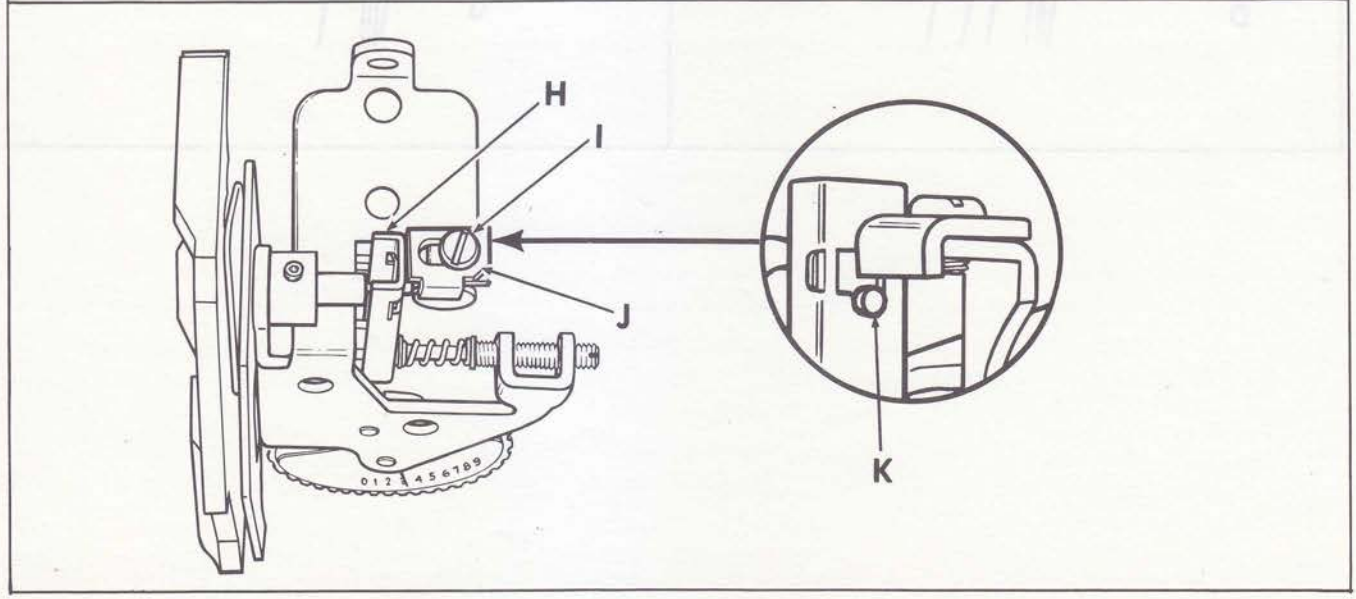
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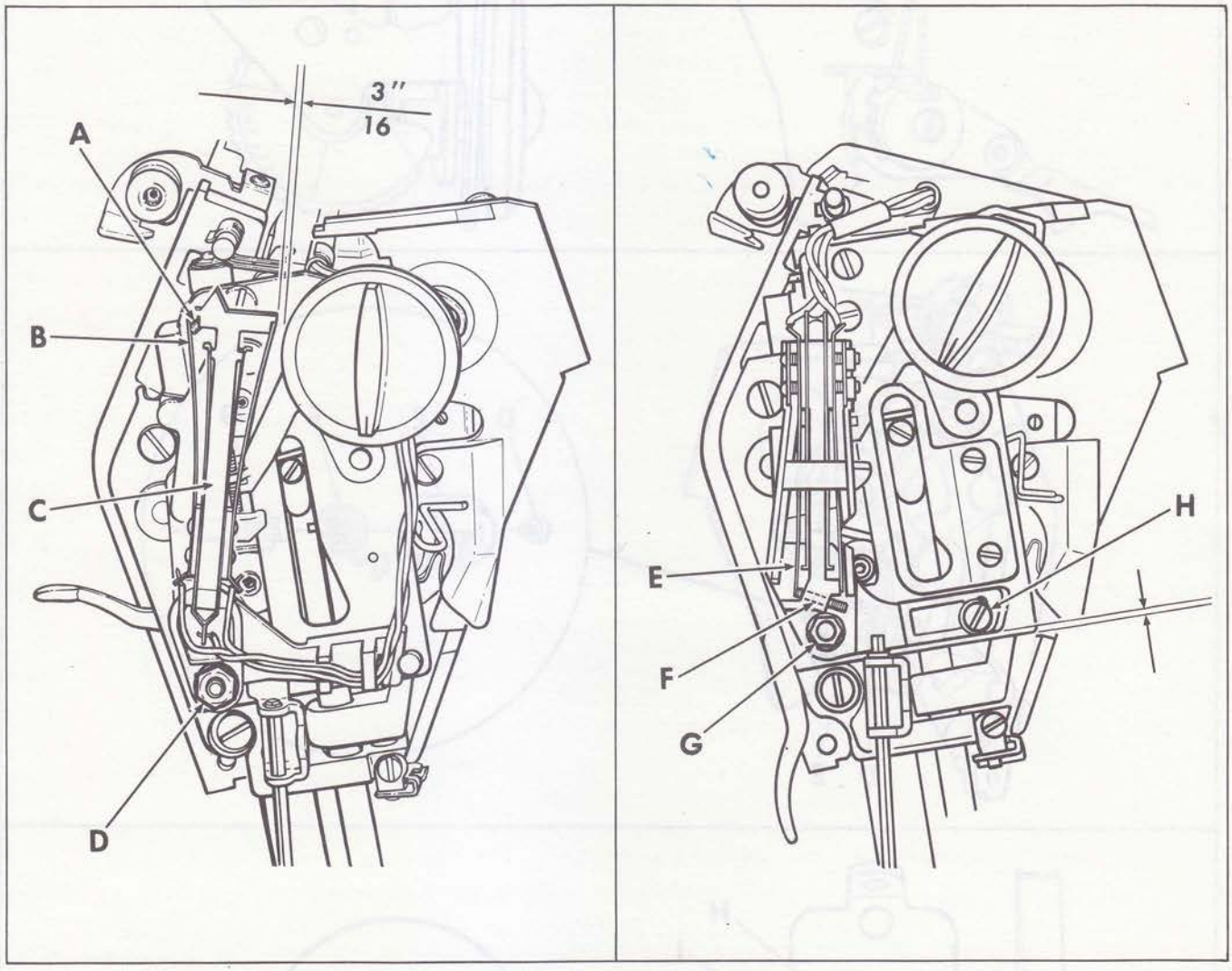
K



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BUTTONHOLE SWITCH

Function:

The buttonhole stop switch serves to signal the end of the left leg of the buttonhole and the closure of the right leg of the buttonhole. When the end of the left leg is reached, the bottom bar-tack occurs and the feed reverses. When the right leg reaches its closure, several tacking stitches occur and all feed and needle action ceases. Always make several buttonholes to verify a malfunction.

Preparation:

1. Remove face plate.

Earlier Production:

Adjustment:

1. Using a straight edge rule, verify distance of 3/16" between top upper right hand vertical edge of the buttonhole switch frame and the outer diameter of the pressure regulating dial.
2. If setting is incorrect, loosen 1/4" hex nut **D** and move buttonhole switch assembly **C** left or right until setting of 3/16" is obtained.
3. Tighten hex nut **D** being careful not to over-tighten so as to create a bind in the buttonhole tripping lever.
4. Using the one-step buttonhole foot make several buttonholes. Verify that the buttonholes are the correct length by measuring the left leg. Do not be concerned about proper closure at this time. If the buttonhole is too long, loosen hex screw **D** and move buttonhole switch assembly **C** to the left. If it is too short, move buttonhole switch assembly **C** to the right.
5. Tighten screw **D** and recheck buttonhole length.
6. Turn .050" hex adjusting screw **A** out (counterclockwise) until it just loses contact with outer leaf contact **B.**
7. Turn adjusting screw **A** in (clockwise) 3/4 of a turn.
8. Test sew several buttonholes for proper closure using one-step buttonhole foot.
9. Make fine adjustment, if necessary, by turning the adjusting screw **A** in (clockwise) to retard the closures or out (counterclockwise) to advance the closure.

Later Production:

1. Verify that bottom edge of buttonhole switch assembly is parallel with bottom edge of head-end assembly plate.
2. If setting is incorrect, loosen nut **G** and screw **H** and properly align the switch assembly.
3. Tighten nut **G** and screw **H** to pinch tightness.
4. Using the one-step buttonhole foot, make several buttonholes. Verify that the buttonholes are the correct length by measuring the left leg. Do not be concerned about proper closure at this time. If the buttonhole is too long, loosen screw **H** and pivot the front of the switch up. If it is too short, pivot the assembly down.
5. Securely tighten nut **G** and screw **H** and recheck buttonhole length.
6. Turn adjusting screw **F** out (counterclockwise) until the outer leaf contact **E** just touches the inner contact.
7. Turn adjusting screw **F** in 3/4 of a turn.
8. Test sew several buttonholes for proper closure.
9. Make fine adjustment, if necessary, by turning the adjusting screw **F** in (clockwise) to retard the closure or out (counterclockwise) to advance the closure.

ELECTRICAL SYSTEM

DESCRIPTION

The 2000 machines operate from an alternating current supply of 110-120 volts A.C., 50-60 Hertz (cycles), at 1.5 ampere. There are no SCR controlled motors for supply voltages higher than 110-120 volts A.C. For operation on an A.C. voltage supply higher than 110-120 volts A.C., use a step down isolation transformer rated at 150 watts (to allow for power surges). Note that the motor is wound for operation on alternating current supply only.

MOTOR BEHAVIOR WHEN ROCKING HAND WHEEL WITH POWER ON

Note that very rapid turning of the hand wheel in reverse or rocking of the hand wheel, with the machine power on, produces a feeling as though the motor belt is jumping cogs on the pulley. This is not happening; the effect is a characteristic of the electrical circuit and is normal for this system. Do not mistake this motor behaviour as a requirement for motor belt adjustment.

MOTOR MOUNTS

To insure quiet and resilient operation, the motors are fitted with urethane sleeves which mate with the motor hinge pins. When replacing a motor, use care when pressing the hinge pins into the sleeves. Excessive pressure can push a sleeve into the motor housing, requiring dismantling of the motor housing to retrieve the sleeve.

CAUTION

When replacing a motor in a 2000 machine, be sure the correct motor is used. Since the 900/920 machine motors use the same motor housing as the 2000, they are identical in appearance. The 2000 machine has a lower torque requirement and the motor, therefore, is designed to meet this requirement. Use of a 900/920 motor in a 2000 machine will cause the machine to run at an excessive speed in the high speed range, thus causing damage to the operating mechanism.

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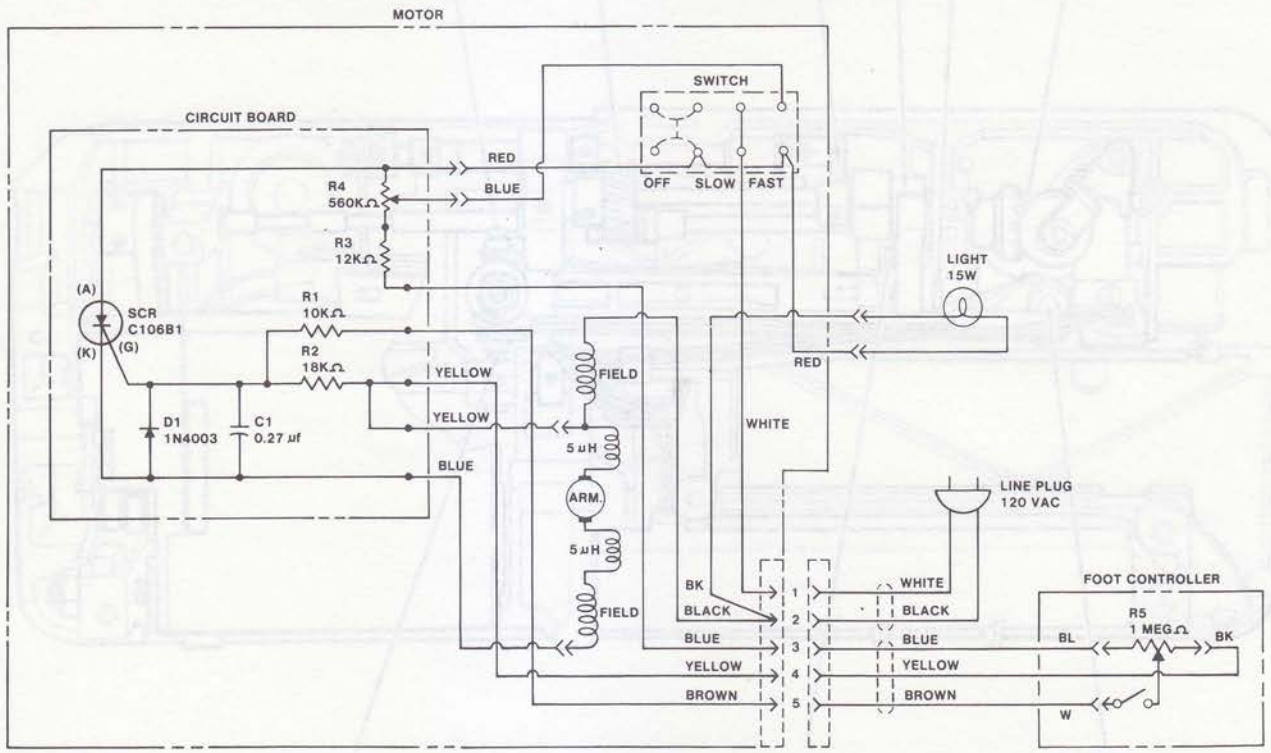
MOTOR
CIRCUIT BOARD
SWITCH
OFF
SLOW
FAST
RED
BLUE
R4
560KΩ
R3
12KΩ
(A)
SCR
C106B1
(K)
(G)
R1
10KΩ
R2
18KΩ
YELLOW
YELLOW
BLUE
D1
1N4003
C1
0.27 µf
FIELD
5 µH
ARM.
5 µH
FIELD
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15W
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120 VAC
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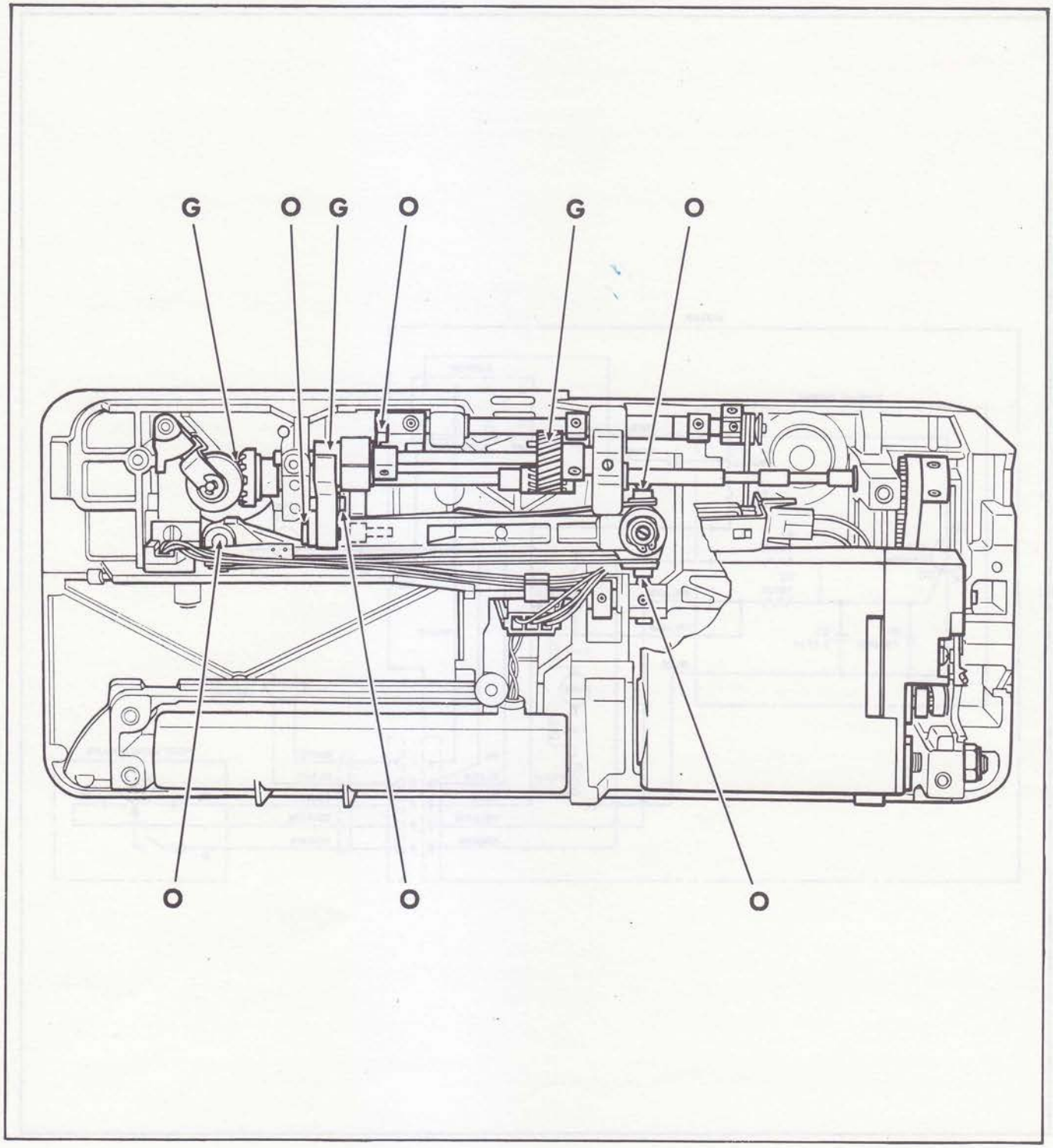

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LUBRICATION

To reliably meet the customer non-lubrication requirements, the machine must be lubricated as described in the following paragraphs.

Only Singer oil and Singer grease must be used.

Use of paraffin based oil, or non-silicon type grease, will create a build-up of residue on the bearing surfaces. The self-lubricating properties of the sintered metal bearings will be defeated by clogging of the pores in the bearings if such oil is used.

All thread, lint, or any foreign matter must be removed before lubrication.

BUSHINGS

Additional oil, two or three drops, is to be applied to the sintered metal bearings, such as rotating shaft bushings, presser bar bushing inserts, rotating hook shaft bushing.

ALPHA FEED SYSTEM

Apply a small amount of grease **G** to the gears and feed lifting eccentric. Lubricate all other frictional areas with two drops of oil **O,** at points indicated.

HEAD-END ASSEMBLY

Apply two or three drops of oil to the take-up lever assembly and needle bar latch. Apply only two drops of oil to the top and bottom bushings of the needle bar. Apply a small amount of grease to the slot of the presser bar pressure regulating dial mounting plate.

SEW-IN TEST

1. Use two plies of 4" x 8" material and polyester thread.
2. Power off.
3. Control settings:
   a. Pattern selector dial left to Dog pattern group.
   b. Stitch width preference control to "0". Full CCW (counterclockwise).
   c. Balance control to center (neutral) position.
   d. Stitch length preference control to "4". Full CW (clockwise).
4. Turn power on.
5. Thread machine, select straight stitch and fill bobbin.
6. Align the left edge of the presser foot with the upper left edge of the fabric. During the sew-in test, continue to use the edge of the presser foot as a guide by aligning it against each previous row of stitching.
7. Activate stitch length preference control.
   Sew one line straight stitch 6" long.
   Set stitch length preference control at No. 2 and sew 4" backtacking three times.
   Set stitch length preference control at No. 1-1/2 and sew 2".
8. Select Dog and Single Pattern and sew one Dog.
9. Reselect Dog and sew second Dog.
10. Sew 2" each of the following patterns:
    a. Tulip.
    b. Leaf.
    c. Zig-zag Point.
    d. Ric-Rac.
    e. Paris Point.
    f. Maxi Stretch.
    g. Ribbon.
    h. Arrowhead.
    i. Bead.
    j. Scallop.
    k. Icicle.
    l. Greek Key.
    m. Honeycomb.
    n. Feather.
    o. Overedge.
    p. Basting.
    q. Surf.
11. Select Blindstitch and sew around edge of fabric, allowing the tacking stitch to sew off the edge of the fabric.
12. Sew 2" each of the following patterns.
    a. Multi-Zig-zag.
    b. "M" Stitch.
    c. Zig-Zag.
13. Set twin-needle safety switch to twin-needle position, activate stitch-width preference control and sew 6" of zig-zag, turning stitch-width preference dial gradually to maximum, "5" setting.
14. Return twin-needle safety switch to single needle position.
15. Install one-step buttonhole foot with underplate.
16. Set reverse stitch balance control to 3:00 o'clock position.
17. Sew one large buttonhole.
18. Return reverse stitch balance control to neutral position and sew second large buttonhole.
19. Sew one small buttonhole.
20. Replace general purpose presser foot.

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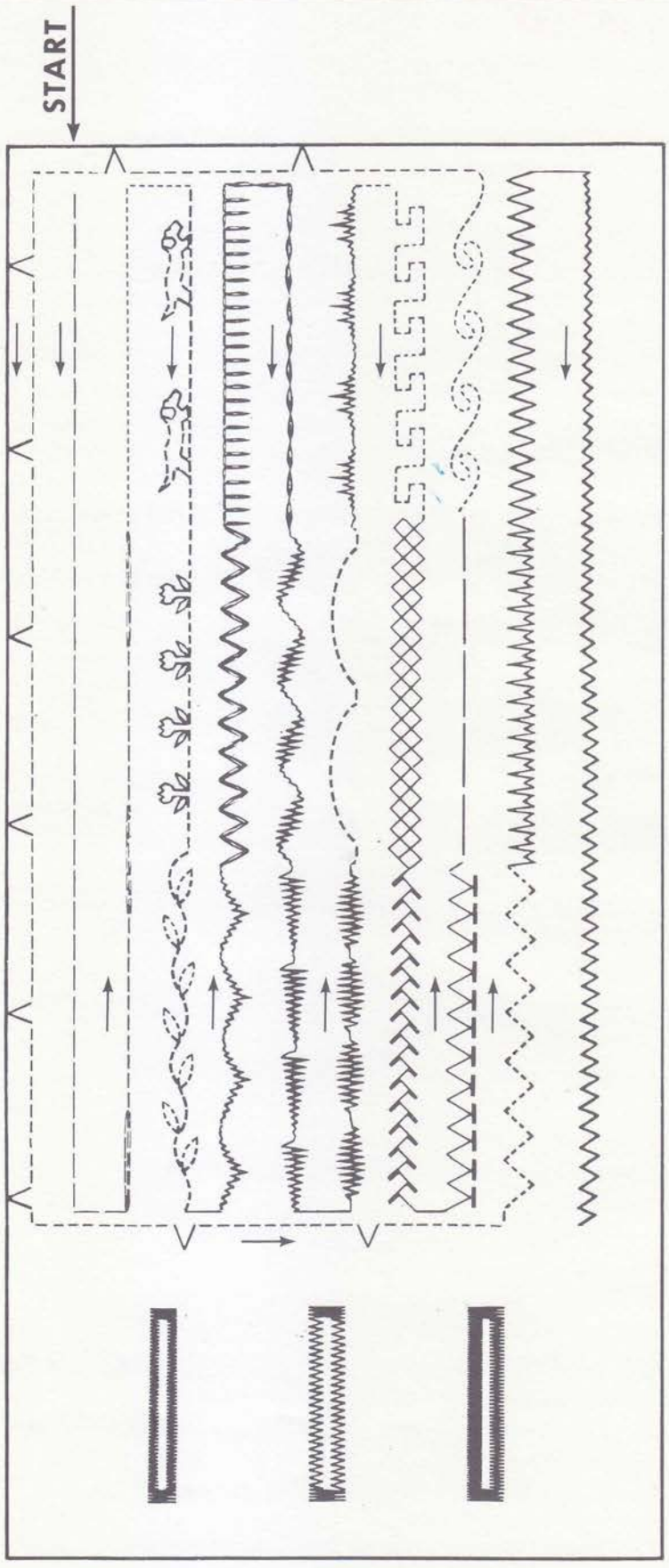

Note: If customer's chainstitch fittings and one-step buttonhole foot are available, be sure chainstitch and buttonhole tests are performed.

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SECTION 5
PARTS REMOVAL & REPLACEMENT

GENERAL

This section covers the procedure for the removal of covers, major components and modules.

The sequence of the steps of procedure is arranged to save time in removal and replacement work, and to avoid, as much as possible, upsetting critical adjustments.

The removal and replacement of major components or modules unavoidably upsets some adjustments. Before proceeding to the final adjustments:

1. Verify all interlocking adjustments.
2. Proper sequence of adjustments must be observed, as referenced in the replacement procedure.

Failure to use the sequential checklist may:

1. Upset previous adjustments.
2. Create new functional faults.
3. Increase the number of readjustments required to put the machine in proper working order.

IMPORTANT

FAILURE TO FOLLOW THE SEQUENTIAL ORDER OF ADJUSTMENTS CAN RESULT IN SELF-DEFEATING EFFORT AND TIME-CONSUMING READJUSTMENTS.

FACE PLATE

Removal:

1. Turn back of machine to face front of bench.
2. Loosen hex socket screw **A.**
3. Remove screw **B** at bottom of face plate.
4. Ease face plate off locating pin at top of arm.

Replacement:

1. Guide face plate on to locating pin.
2. Align screw hole in place with hole in arm. Thread screw **B** into arm. Seat face plate correctly before tightening screw **B** first and set screw **A** last.

TOP COVER

Removal:

1. Slightly raise right rear corner of top cover. Illustration **C.**
2. Place thumb into take-up lever well and press top cover to the right.
3. Lift right end of cover and remove from machine.

Replacement:

1. Place cover flat on top of the machine arm with the hold-down clamps to the right of the hold-down screw studs.
2. Press cover to the left being sure the hold-down clamps are properly located under the hold-down screw studs.

FRONT COVER

Removal:

1. Lower light and remove light lens **D** by pulling it toward bed of machine. Return light socket to its stored position.
2. Remove cover screw **E** to right of tension dial.
3. Remove cover screw **F** under control panel cover.
4. Remove cover screw **G** located inside of recess in casting above the motor plug.
5. Pull front cover toward you about 1/2". If there is resistance, look for interference of cover with lens spring clip. Grasp lower right hand end of panel and draw panel toward you, pivoting on the left end and clearing harness along left side of override board.
6. Tilt right end upward and pivot on front end to clear tension and light reflector.

Replacement: Replacement is the same as removal in reverse order.

BOTTOM COVER

Removal:

1. Lay machine on its back on a soft cloth and remove two slotted screws **H,** Phillips head screw **I,** and four cushion screws **J.**
2. Draw bottom cover off the machine.

NOTE: If work is to be done on the machine, the four bed cushions and screws **MUST** be replaced to prevent the circuit breaker from being depressed and, thereby, opening the circuit when the machine is in an upright position.

Replacement: Replacement is the same as removal in reverse order.

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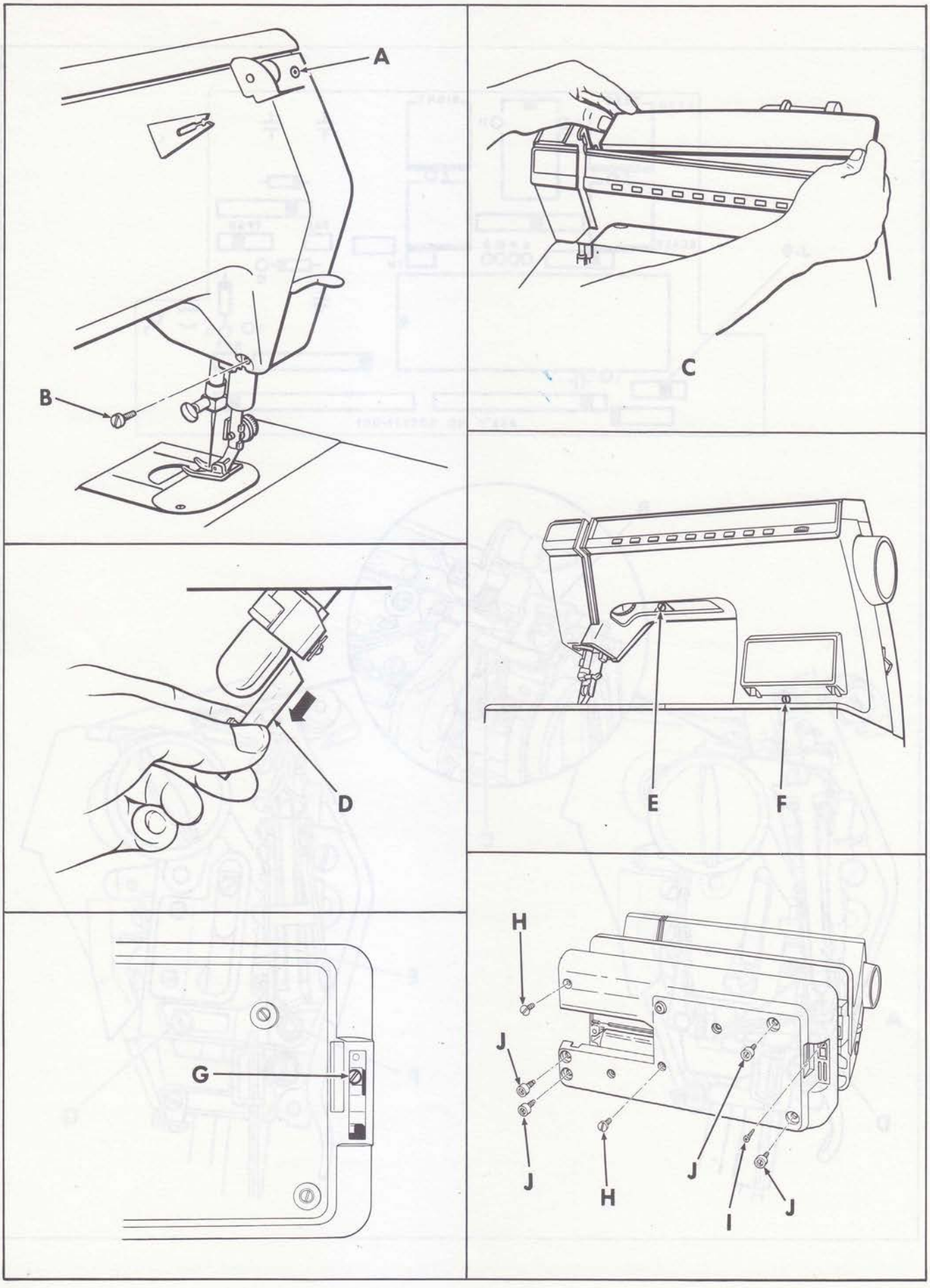
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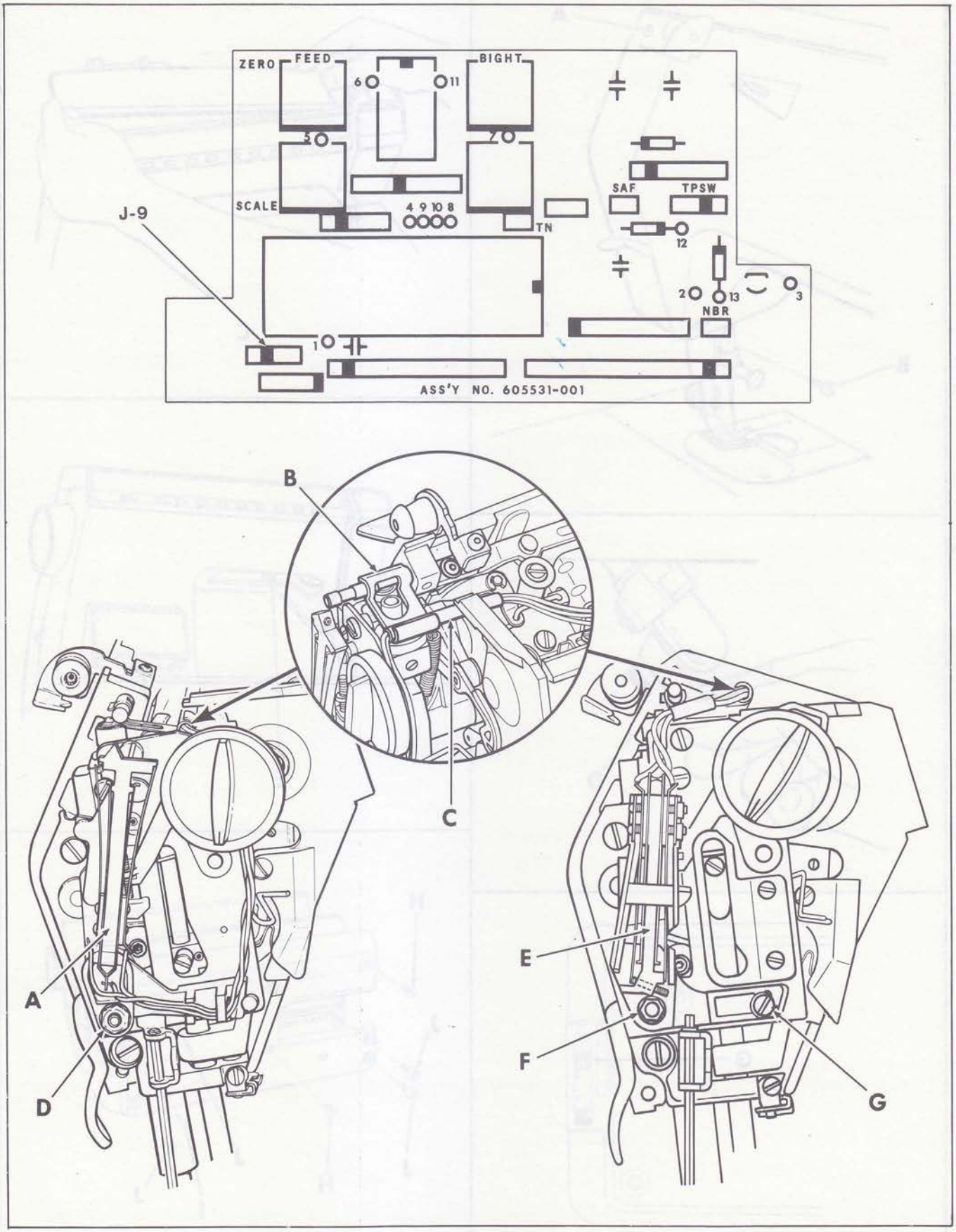

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BUTTONHOLE SWITCH

Removal:

1. Remove face plate and arm top cover.
2. Remove plug J-9 from logic board assembly.
3. Snap harness grommet **C** out of retaining clip **B.**

Earlier Production:

1. Remove buttonhole switch mounting nut and washer **D.**
2. Remove buttonhole switch **A** from head end.

Later Production:

1. Remove buttonhole switch mounting nut with washer **F** and screw with washer **G.**
2. Remove buttonhole switch **E** from head end.

Replacement:

1. Be sure hole in buttonhole tripping rod lever is properly mounted on stud of buttonhole switch assembly and that the stud on the buttonhole rod tripping lever is properly located between the two inner leaf contacts.
2. Replacement is the same as removal in reverse order.
3. Do not overtighten. Buttonhole rod tripping lever should move easily without any bind.
4. Adjust buttonhole switch.
5. Replace arm top cover and face plate.

HEAD-END ASSEMBLY

Removal:

1. Remove face plate and arm top cover.
2. Remove presser foot with presser foot shank.
3. Set presser bar to down position.
4. Remove needle.
5. Remove screw **C** with washer, connecting needle bar ball joint and needle bar driving arm.
6. Remove buttonhole switch **A** and place it to the rear of the machine.
7. Turn hand wheel toward front of machine to bring needle bar to its highest point.
8. Remove lower (positioning) screw **J** and internally serrated washer **I** and upper pivot screw **F** and flat washer **E.**
9. Remove head-end assembly by drawing straight out from casting.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust needle location.
3. Adjust needle bar release solenoid.
4. Adjust buttonhole switch.
5. Replace arm top cover and face plate.

NEEDLE BAR

Removal:

1. Remove face plate.
2. Remove needle clamp thread guide **P** and needle clamp **O.**
3. Loosen needle bar clamping screw **R.**
4. Pull needle bar **Q** up and out of head-end assembly.

Replacement:

1. Replace needle bar in head-end assembly and tighten clamping screw **R** to pinch tightness.
2. Reset needle bar height.
3. Check that needle bar latch engages properly.
4. Replace face plate.

PRESSER BAR AND PRESSER BAR BUSHING

Removal:

1. Remove face plate and arm top cover.
2. Set pressure regulating dial to DARN.
3. Remove plug J-9 from logic board assembly.
4. Snap harness grommet **D** out of retaining clip **B.**
5. Remove head-end assembly with buttonhole switch.
6. Loosen presser bar clamping screw **K.**
7. Pull presser bar **N** down and out of head-end assembly.
8. Loosen presser bar bushing clamping screw **L.**
9. Pull presser bar bushing **M** down and out of head-end assembly.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust presser bar height, alignment and pressure.
3. Adjust needle location.
4. Replace arm top cover and face plate.

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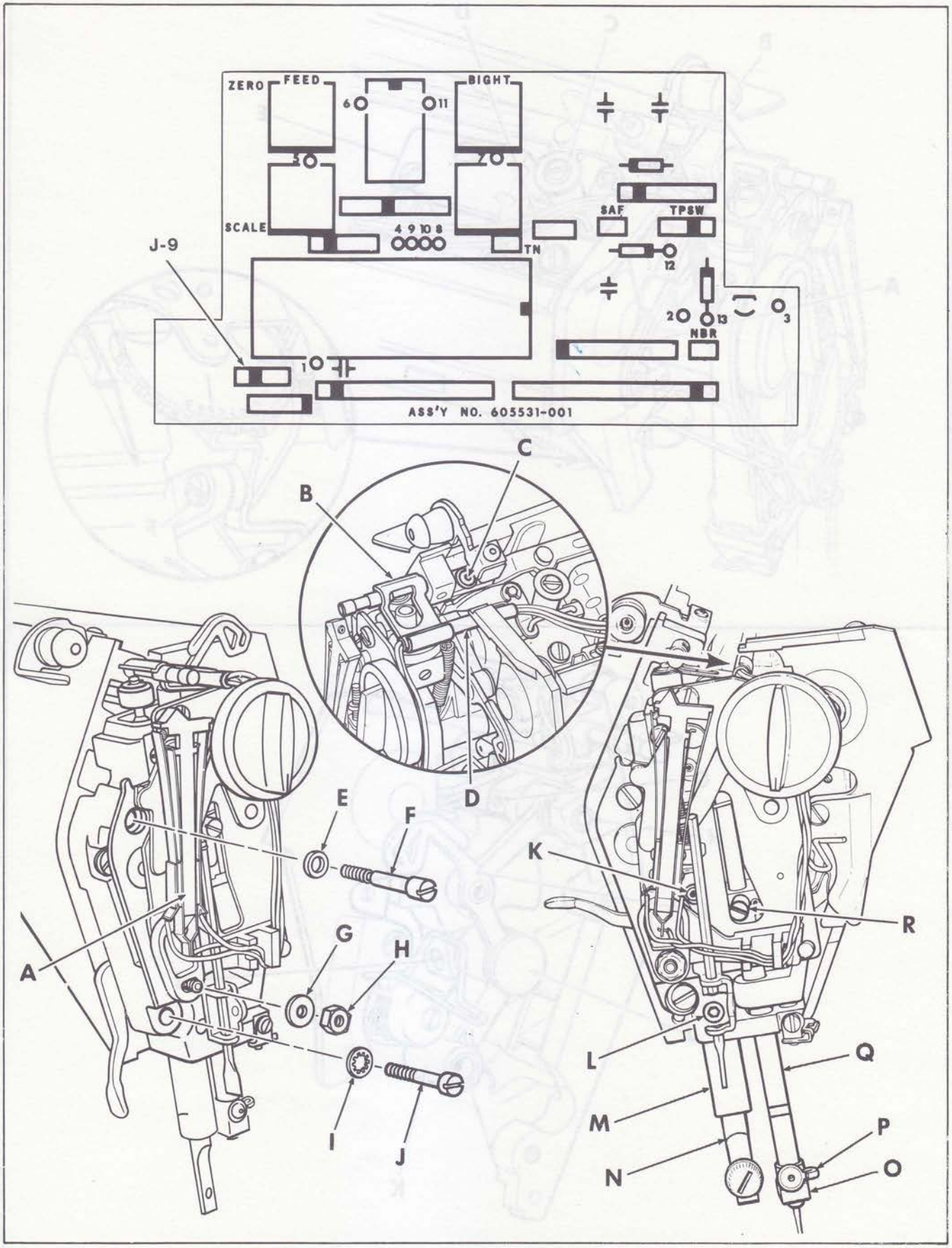
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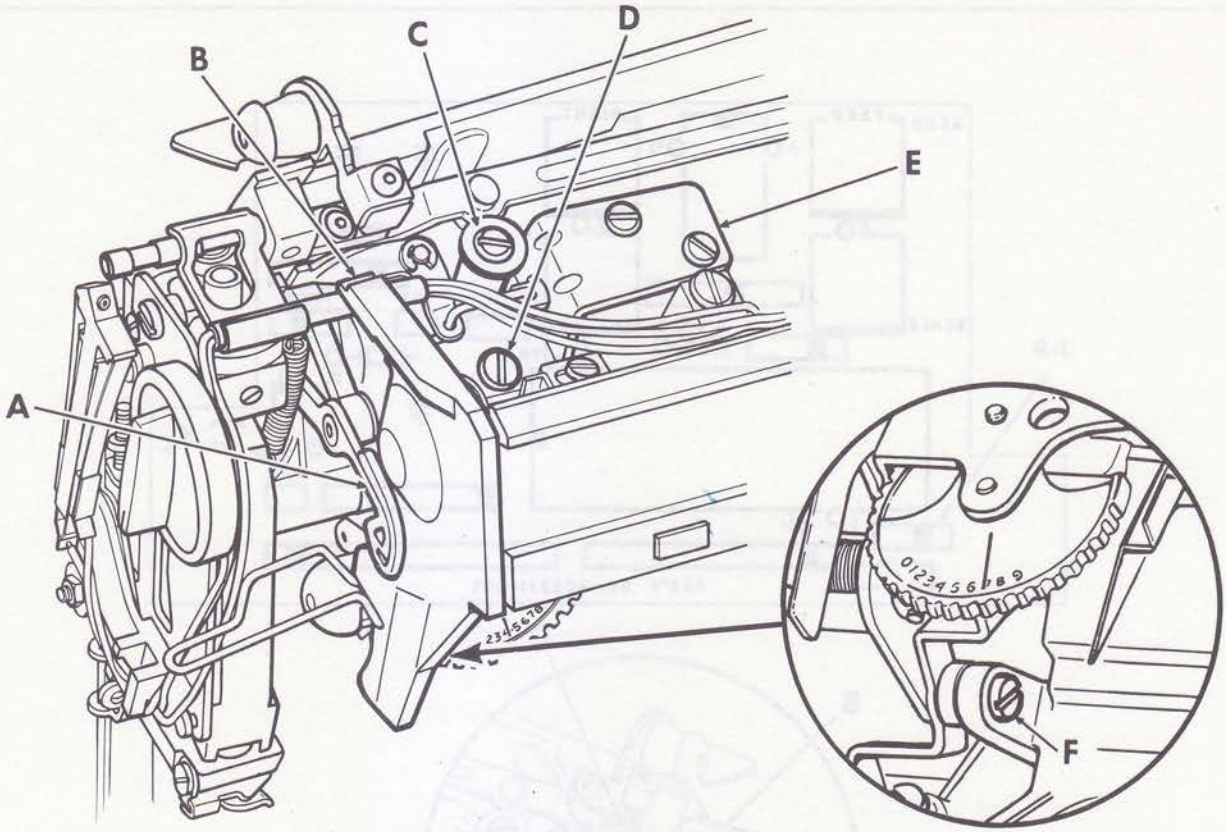

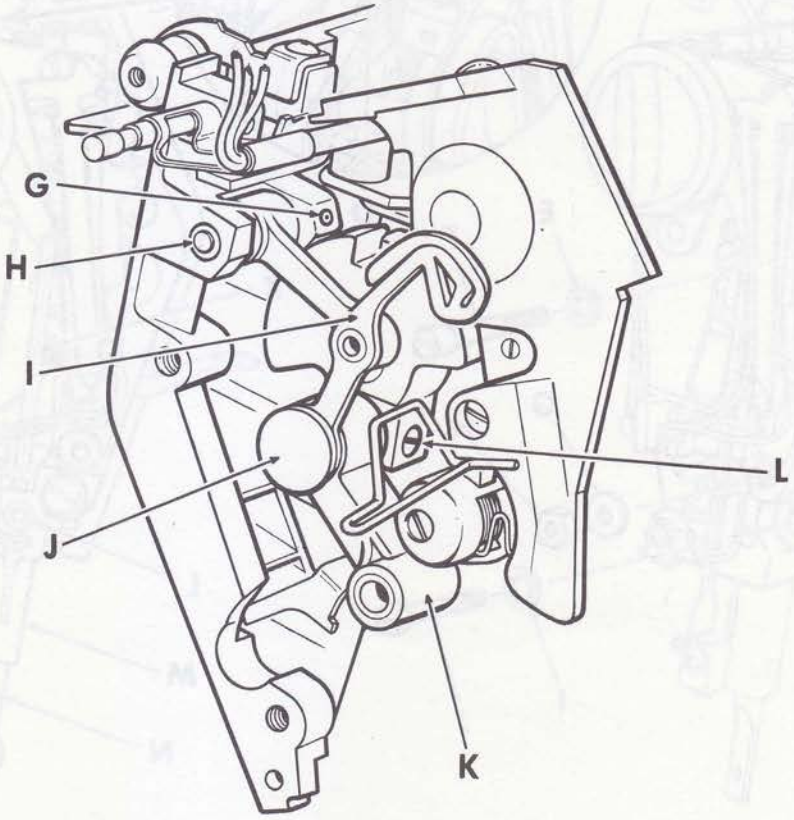

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TENSION ASSEMBLY

Removal:

1. Remove face plate, arm top cover and front cover.
2. Turn hand wheel toward front of machine to bring take-up lever **A** to its lowest point.
3. Remove screw **F** under arm at head end.
4. Remove arm top screw stud **C** and mounting screw **D.**
5. Remove needle bar release solenoid **E** and lay it to rear of machine.
6. Tilt top of tension assembly **B** toward the left and down, and remove from machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Check tension module for correct tension release.
3. Adjust needle bar release solenoid.
4. Replace front cover, arm top cover, and face plate.

TAKE-UP LEVER ASSEMBLY

Removal:

1. Remove face plate, arm top cover, front cover, head-end assembly and tension assembly.
2. Loosen take-up lever hinge stud set screw **G.**
3. Loosen thread take-up crank set screw **L.**
4. Push take-up lever hinge stud **H** toward the left and pull it out.
5. Hold needle bar connecting link **K** and ease out thread take-up crank **J** and thread take-up lever **I.**

Replacement:

1. Replacement is the same as removal in reverse order.

LINEAR SERVO BOARD P.C. ASSEMBLY

Removal:

1. Remove top cover.
2. Remove mounting screws **B** and **E** and arm top screw stud **D.**
3. Carefully lift and tilt up front edge of servo board assembly.
4. Remove plugs J-15, J-6, J-18, and J-17 from the servo board assembly.

Replacement:

1. Replacement is the same as removal in reverse order.

NOTE: When replacing servo board assembly, it is mandatory that a liberal amount of thermal transfer compound be spread over both mating surfaces of the circuit board's aluminum mounting (heat sink) and the arm standard before securing board to the machine.

PATTERN SELECTION BUTTON CARRIER ASSEMBLY

Removal:

1. Remove arm top cover and front cover.
2. Remove servo board assembly but do not remove plugs. Carefully place the servo board assembly over the rear of the arm standard as shown in illustration **G.**
3. Replace screw **B** in spacer **F** and tighten to pinch tightness to maintain stability of the logic board assembly.
4. Remove button carrier assembly mounting screws **A** and **C.**
5. Carefully withdraw the button carrier assembly away from the logic board assembly as shown in illustration **G.**
6. Remove plugs J-10 and J-11 from the logic board assembly.

Replacement:

1. Replacement is the same as removal in reverse order.

MASTER CONTROL LOGIC BOARD ASSEMBLY

Removal:

1. Remove arm top cover and front cover.
2. Rotate hand wheel to bring needle bar to its highest point.
3. Remove servo board assembly and carefully place servo board assembly over the rear of the arm as shown in illustration **G.**
4. Remove plug J-15 from the servo board assembly.
5. Remove plugs J-9, J-5, J-8, J-16, J-13, J-14, J-7, and J-12 from the logic board assembly.
6. Remove button carrier assembly mounting screws **A** and **C.**
7. Carefully withdraw button carrier assembly with the logic board assembly complete.
8. Remove spacer and retainer **F** from logic board assembly.
9. Carefully slide the logic board assembly out of the button carrier assembly.
10. Remove plugs J-10 and J-11 from the logic board assembly.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Check linear bight and feed zero and scale potentiometer adjustments at test points 8 and 9 on the logic board assembly.
3. Replace front cover and arm top cover.

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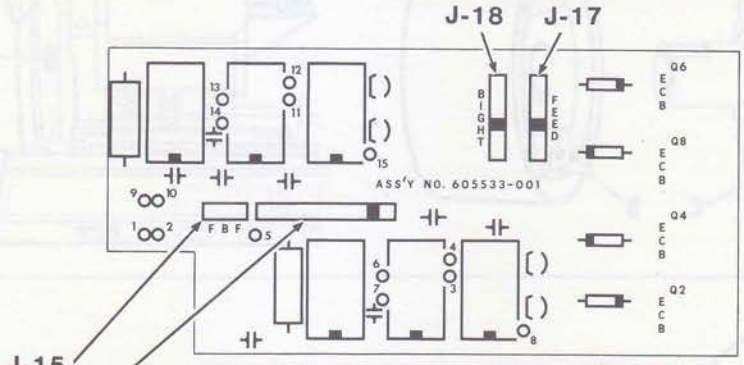
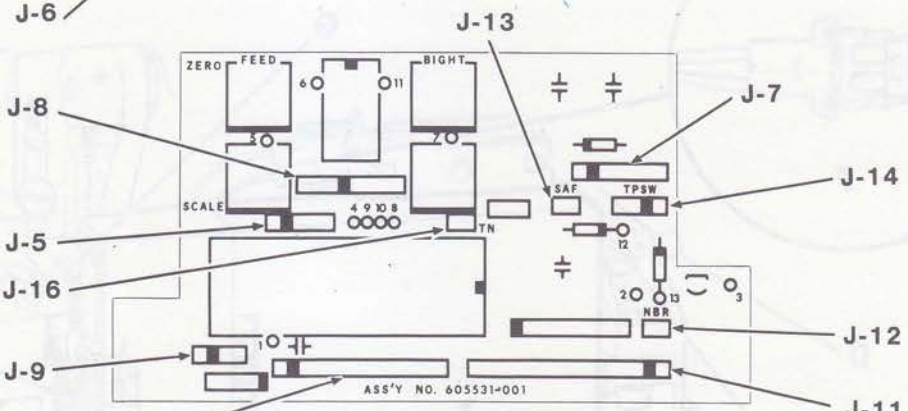
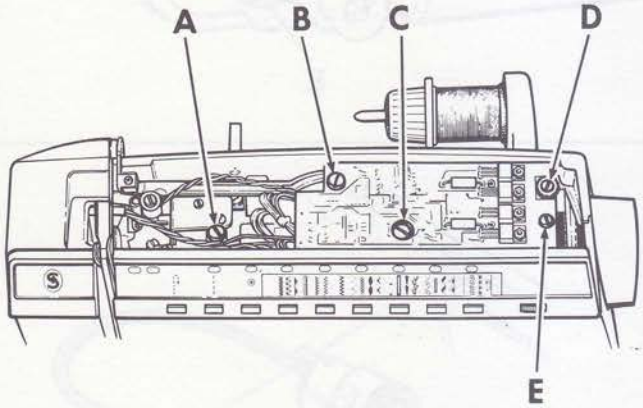
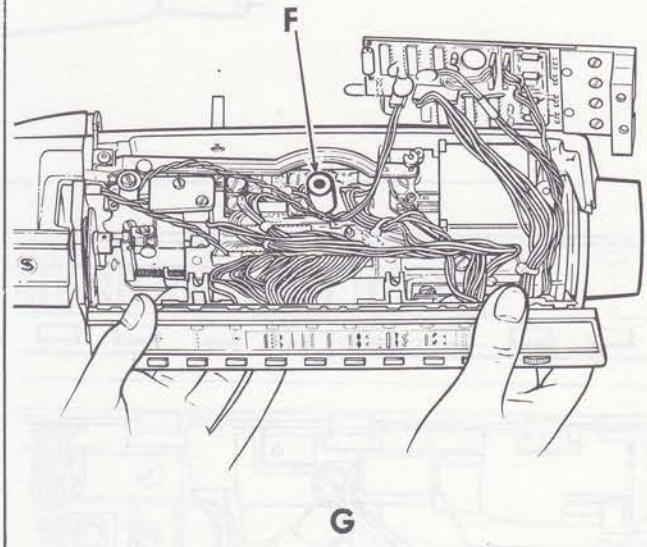


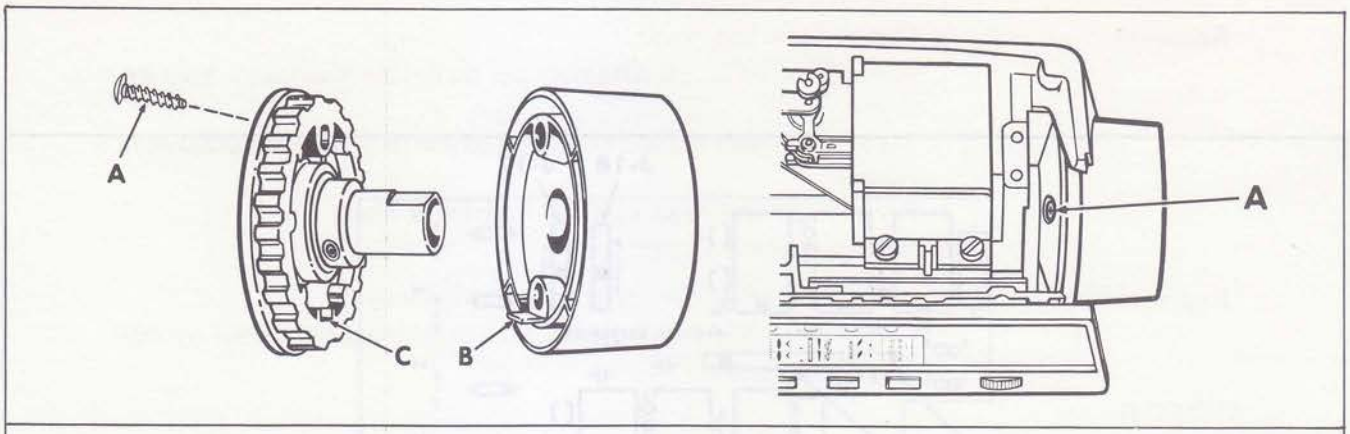
LINEAR SERVO BOARD ASSEMBLY

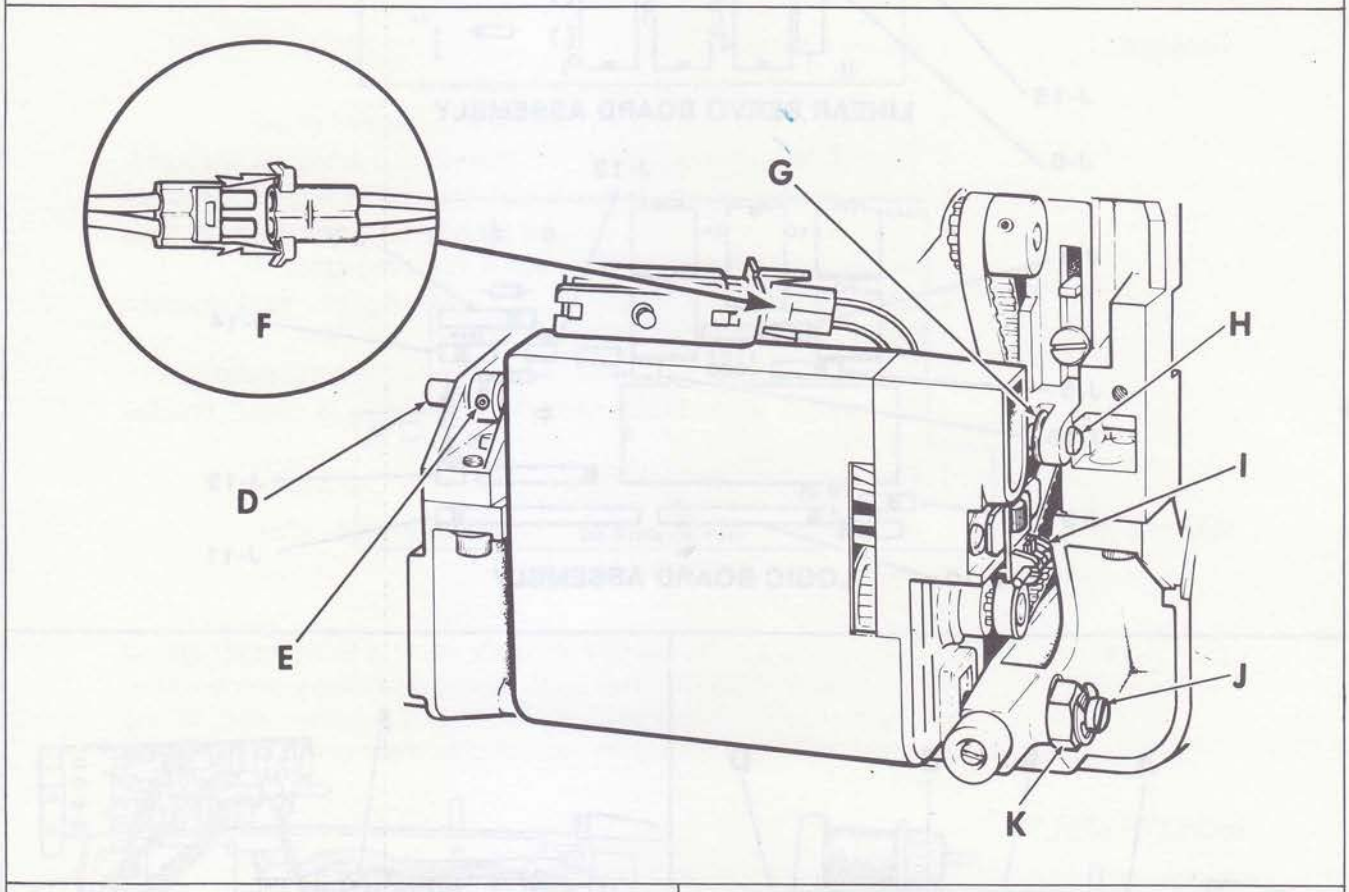


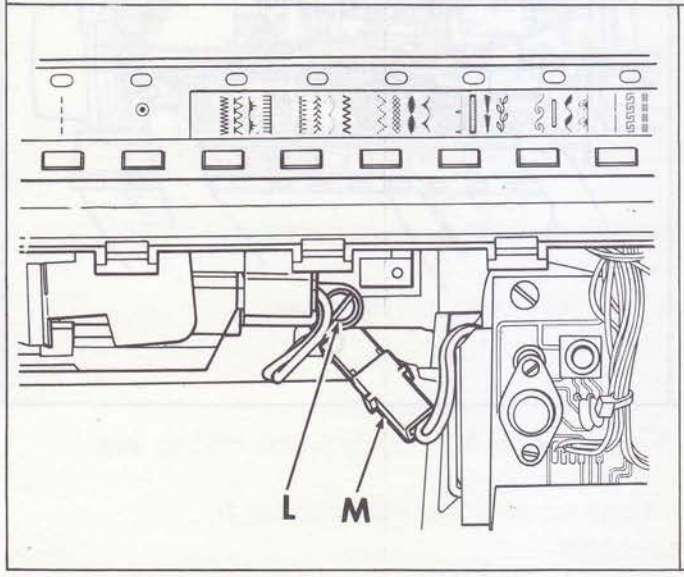
LOGIC BOARD ASSEMBLY

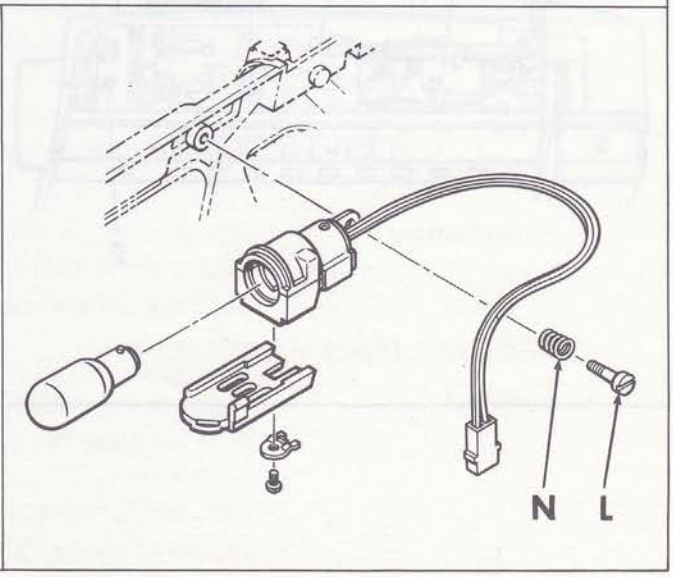












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HAND WHEEL

Removal:

1. Remove arm top cover.
2. Remove servo board assembly but do not remove plugs from the board.
3. Turn hand wheel toward front of machine until hole in sprocket is visible.
4. Remove Phillips head screw **A** from hand wheel.
5. Pull hand wheel straight out.

Replacement:

1. Insert hand wheel key **B** in sprocket keyway **C.**
2. Replace and tighten screw **A.** Do not overtighten screw as this may cause runout in the hand wheel.

MOTOR

Removal:

1. Remove bottom cover.
2. Loosen lock nut **K** on eccentric screw **J.**
3. Turn eccentric screw **J** for maximum looseness of belt.
4. Disengage switch actuating rod from switch actuating bracket **I.**
5. Remove retaining ring **G** from motor hinge pin **H.** Pull out hinge pin.
6. Loosen hex socket head screw **E** in collar on left hinge pin **D.** Ease pin away from motor housing until it is disengaged.
7. Unscrew eccentric screw **J** until it disengages from urethane motor adjusting block on motor housing.
8. Position motor to allow belt to be slipped off motor pulley.
9. Disconnect Mate-N-Lock terminal **F** attached to circuit breaker bracket.
10. Remove motor from machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust motor belt tension.
3. Replace bottom cover.

CAUTION: DO NOT PRY BELT ON OR OFF PULLEY WITH A SCREWDRIVER OR OTHER SHARP OBJECT. The belts have glass fibers which crack, causing belt failure, when belts are pried over a pulley. Also, for the same reason, belts must not be subjected to sharp bends between the fingers.

MOTOR BELT

Removal:

1. Remove arm top cover, front cover, and bottom cover.
2. Remove hand wheel.
3. Loosen lock nut **K** on eccentric screw **J.**
4. Turn eccentric screw **K** for maximum looseness of belt.
5. Ease belt off arm shaft sprocket and draw it out through bottom of machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust motor belt tension.
3. Replace bottom cover, arm top cover, and top cover.

SEWING LIGHT ASSEMBLY

Removal:

1. Remove front cover.
2. Remove Mate-N-Lock connector **M** from cavity in arm casting and disconnect.
3. Remove light bracket hinge screw **L** with coiled spring **N.**
4. Remove sewing light assembly.

Replacement:

1. Replacement is the same as removal in reverse order.

ARM SHAFT SPROCKET - TIMING BELT

Removal:

1. Remove arm top cover, front cover and bottom cover.
2. Remove hand wheel.
3. Loosen lock nut **B** on eccentric screw **C.**
4. Turn eccentric **C** for maximum looseness of motor belt.
5. Ease motor belt off arm shaft sprocket.
6. Loosen idler pulley eccentric set screw **D.**
7. Turn eccentric **E** for maximum looseness of belt.
8. Remove arm shaft sprocket set screw **G.**
9. Pull arm shaft sprocket **F** off arm shaft.
10. Remove timing belt from lower cogged pulley **A** and draw it out from bottom of machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust radial position of arm shaft sprocket.
3. Adjust motor belt and timing belt tensions.
4. Adjust hook and feed timing.
5. Replace bottom cover, front cover, and arm top cover.

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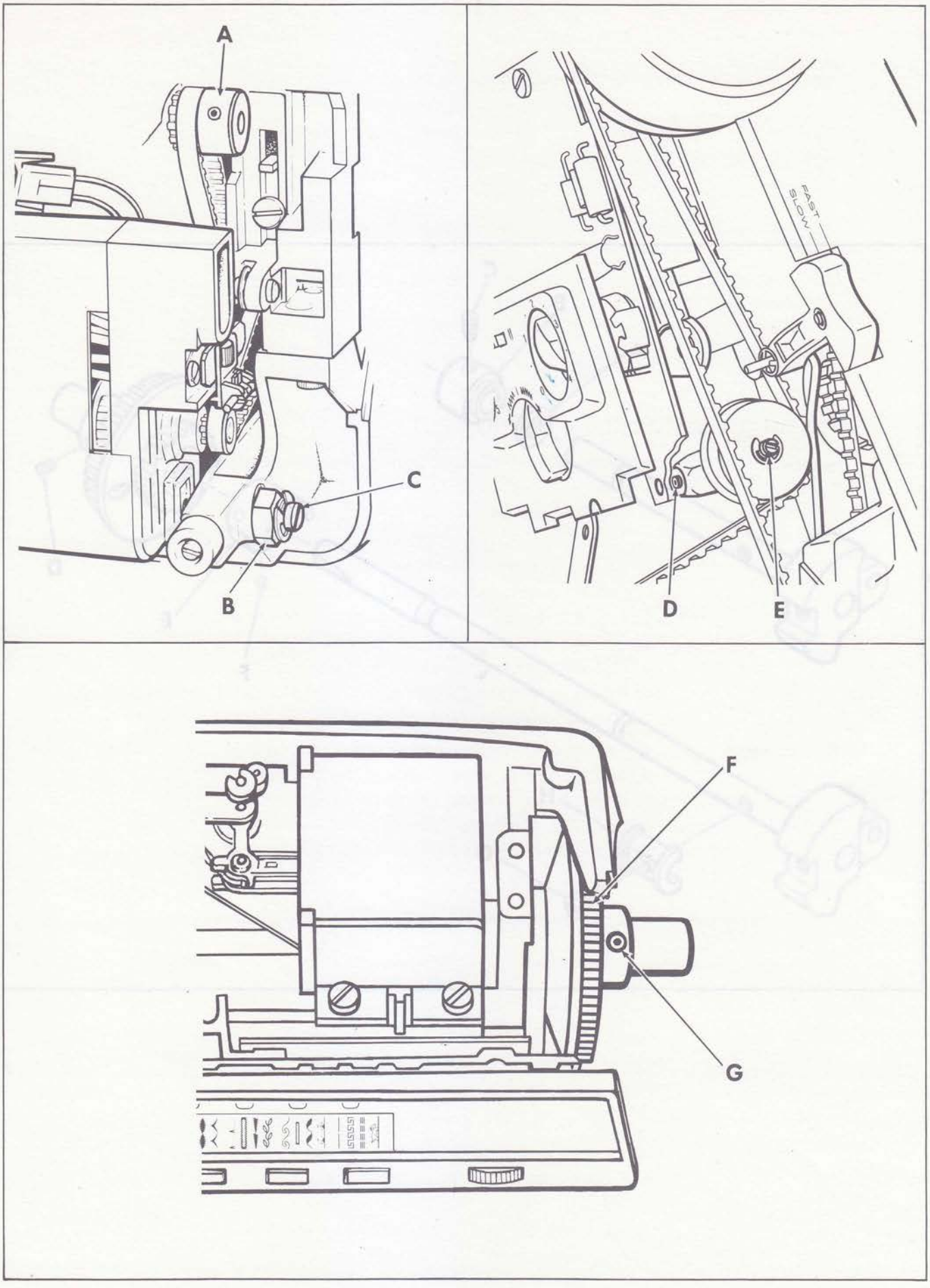
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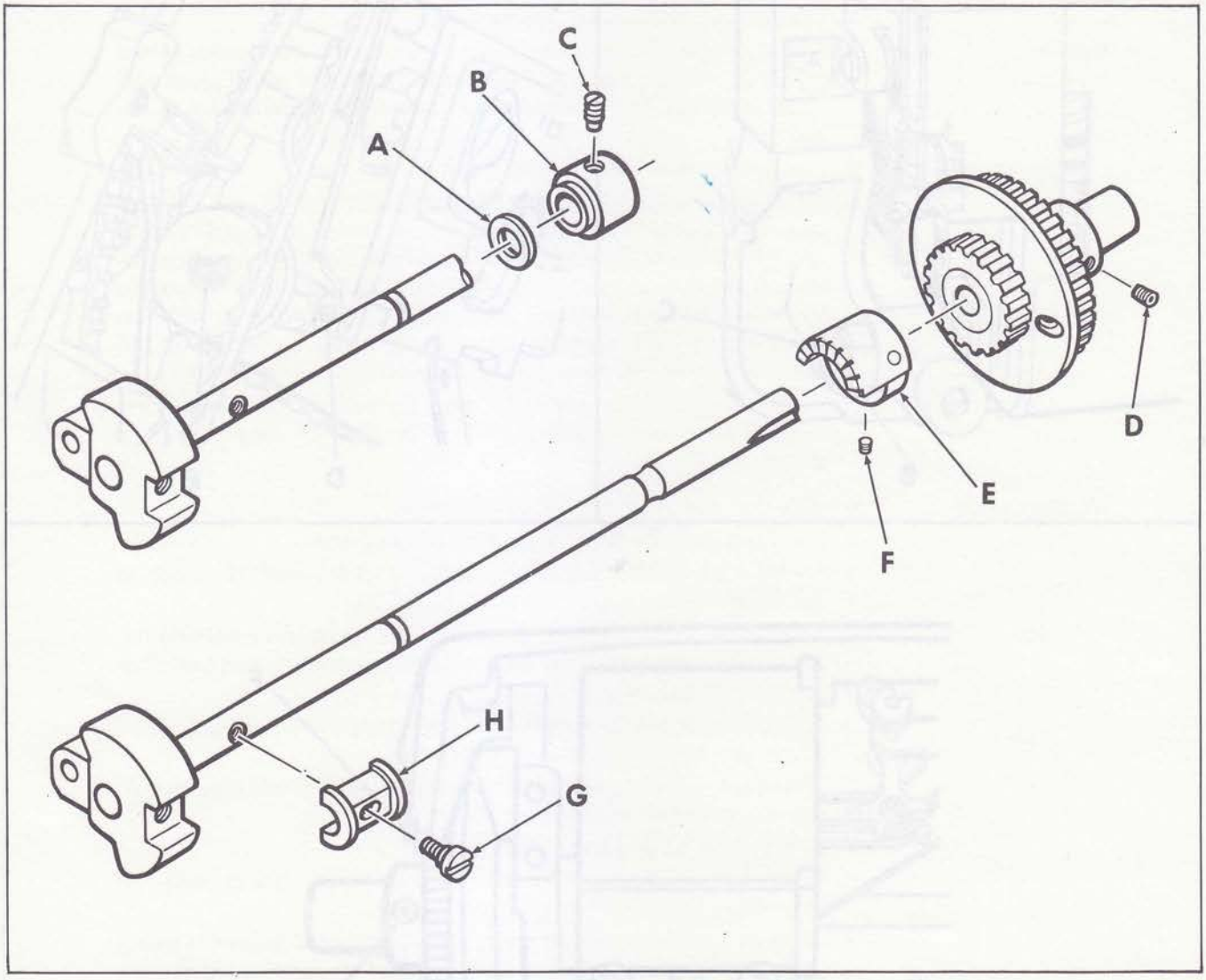

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ARM SHAFT

Removal:

1. Remove face plate, arm top cover, front cover and bottom cover.
2. Remove linear servo board assembly.
3. Remove button carrier assembly with logic board assembly.
4. Remove head-end assembly, tension assembly and take-up lever assembly.
5. Remove hand wheel.
6. Remove motor belt from arm shaft sprocket.
7. Loosen arm shaft collar set screw **C.**

NOTE: Earlier production machines used a plastic arm shaft collar **H** and screw **G.** These should be removed and replaced with a steel collar part No. 382897 whenever an arm shaft replacement is required.

8. Loosen set screw **F** in timing shunt **E.**
9. Remove set screw **D** in arm shaft sprocket but do not remove sprocket. Using an old arm shaft or 3/8" drill rod as a threading tool, gradually pull the arm shaft out of the sprocket hub while inserting the threading tool into the hub. Continue to withdraw the arm shaft through the arm shaft bushing following it with the threading tool. By carefully maintaining timing belt mesh on the arm shaft sprocket, hook and feed timing will not be upset.
10. Continue to remove arm shaft out of machine, removing timing shunt and arm shaft collar from the arm shaft as the arm shaft is withdrawn.

Replacement:

1. Thread nylon washer **A** on to arm shaft.
2. Push arm shaft through its bearing at head end.
3. Replace arm shaft collar **B** and timing shunt **E** on arm shaft but do not tighten set screws.
4. Thread the arm shaft through its arm casting bearing, holding the sprocket firmly against the arm casting to prevent timing belt slippage off sprocket.
5. Thread screw **D** into sprocket hub and temporarily secure screw to prevent lateral movement of sprocket.
6. Adjust arm shaft and arm shaft sprocket radial and end play as outlined in arm shaft adjustment procedure.
7. Replace motor belt and hand wheel.
8. Replace take-up lever assembly, tension assembly and head-end assembly.
9. Replace button carrier assembly with logic board assembly being careful to locate timing shunt to the right of the logic board assembly magnet.
10. Temporarily secure timing shunt set screw **F** to prevent lateral movement. Be sure there is clearance between the shunt and the magnet to prevent interference when the arm shaft is rotated.
11. Replace linear servo board assembly.
12. Adjust motor belt tension.
13. Reset correct needle location.
14. Reset correct needle crossover.
15. Check hook and feed timing.
16. Perform bind test for bight mechanism.
17. Replace bottom cover, front cover, arm top cover and face plate.

NEEDLE BAR RELEASE SOLENOID

Removal:

1. Remove face plate and arm top cover.
2. Remove servo board assembly but do not remove plugs from the board.
3. Tilt servo board assembly to gain access to plug J-12 on the logic board assembly and disconnect.
4. Disconnect plug J-9 on the logic board assembly.
5. Remove solenoid bracket mounting screw **H** and arm top screw stud **F.**
6. Lift needle bar release solenoid assembly out of machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust needle bar release mechanism.
3. Replace arm top cover and face plate.

NEEDLE BAR DRIVING ARM

Removal:

1. Remove face plate and arm top cover.
2. Remove screw **A** with washer, connecting needle bar ball joint and needle bar driving arm.
3. Remove servo board assembly but do not remove plugs from the board.
4. Remove needle bar driving arm spacer **E** with clamping ring.
5. Lift needle bar driving arm **D** off linear bight motor link and remove from arm of machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust needle location.
3. Perform bind test for bight mechanism.
4. Replace arm top cover and face plate.

NEEDLE BAR DRIVING ARM POSITIONING SOLENOID

Removal:

1. Remove face plate, arm top cover and front cover.
2. Remove servo board assembly and disconnect plug J-15.
3. Remove button carrier and logic board assemblies complete.
4. Remove needle bar driving arm.
5. Remove positioning solenoid bracket mounting screws **B** and **C.**
6. Remove positioning solenoid assembly complete from the machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Check that positioning solenoid lever seats properly on needle bar driving arm stud.
3. Perform bind test for bight mechanism.
4. Replace front cover, arm top cover and face plate.

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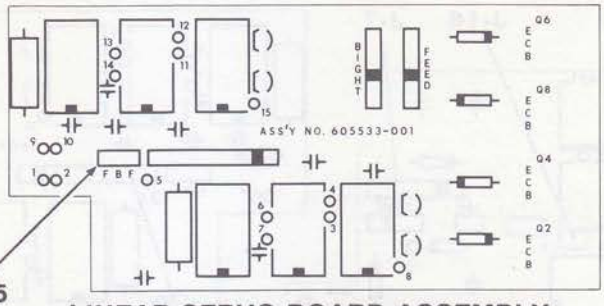
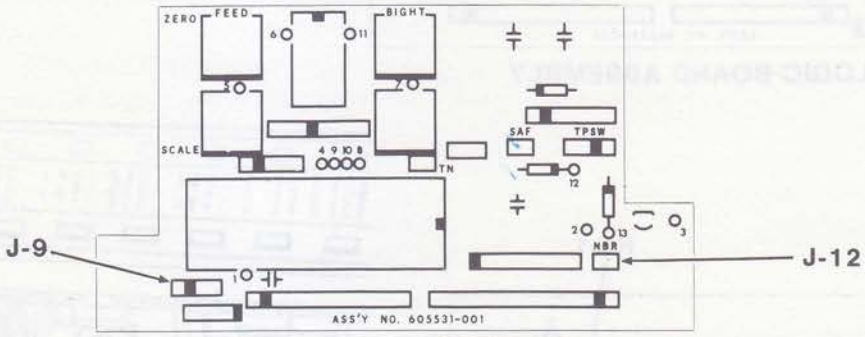
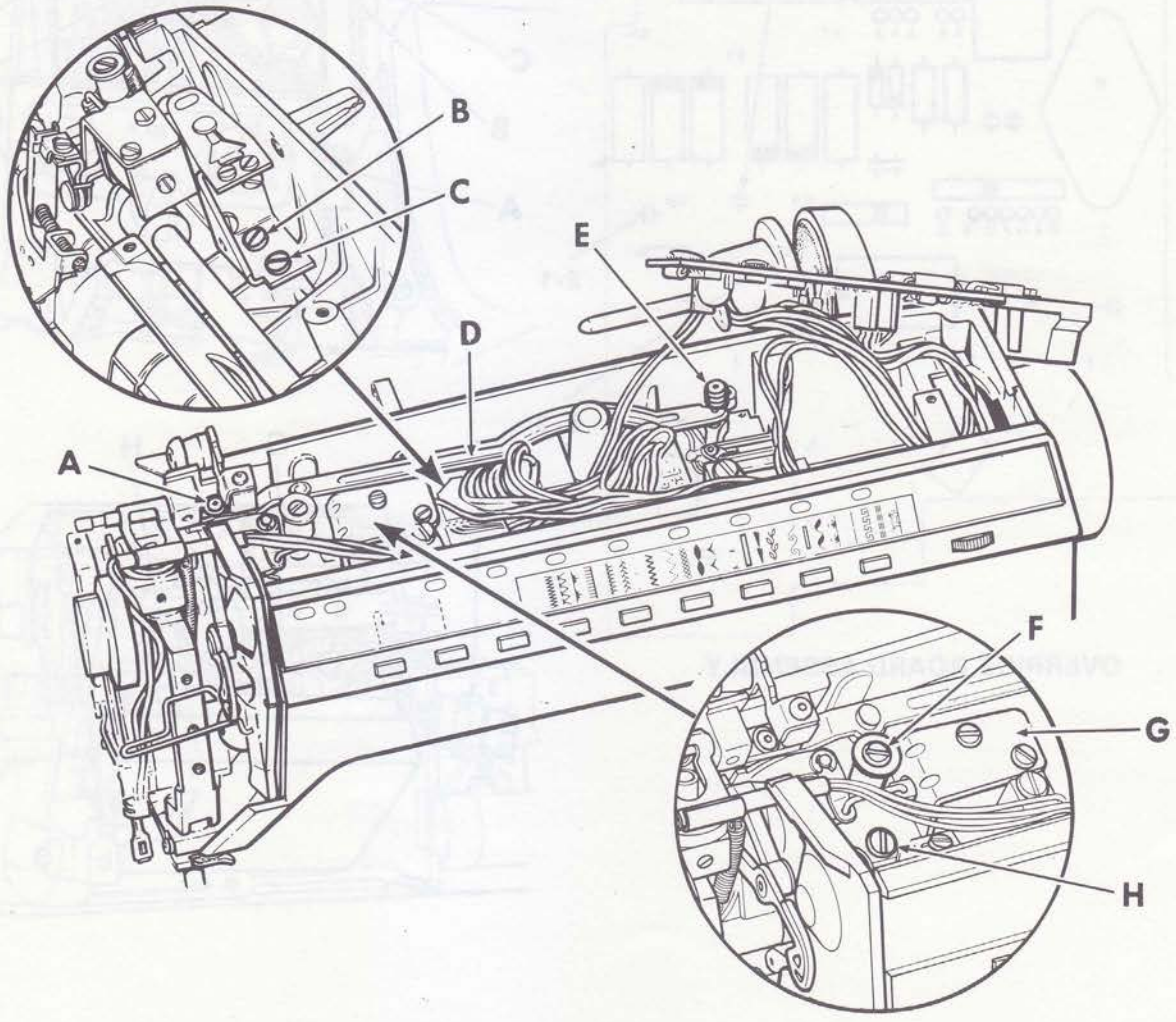
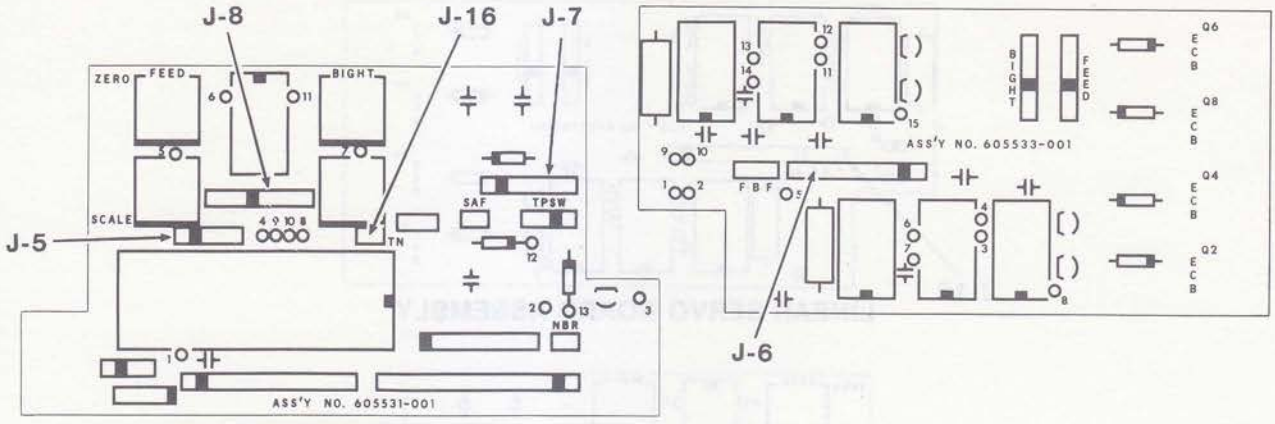


LINEAR SERVO BOARD ASSEMBLY



LOGIC BOARD ASSEMBLY





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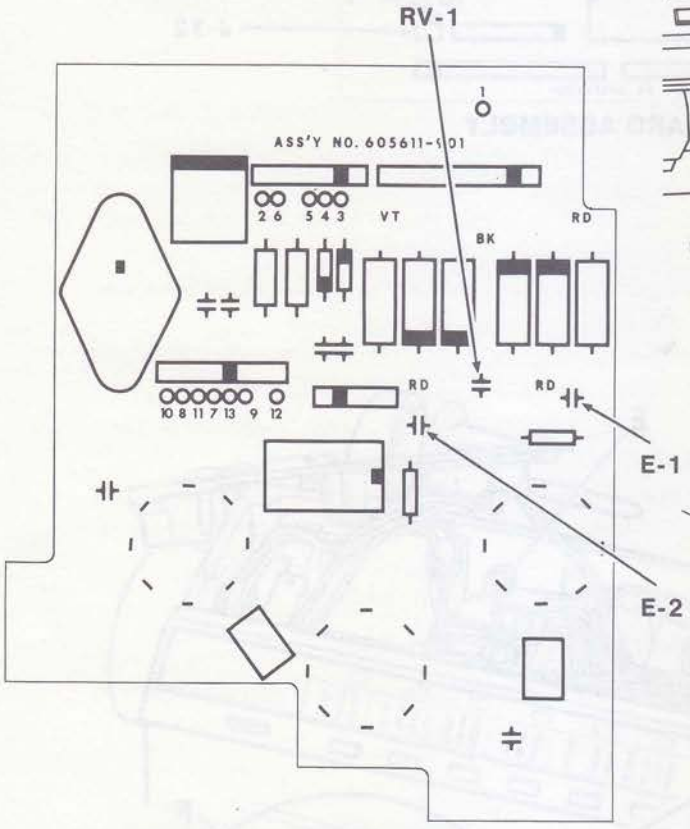
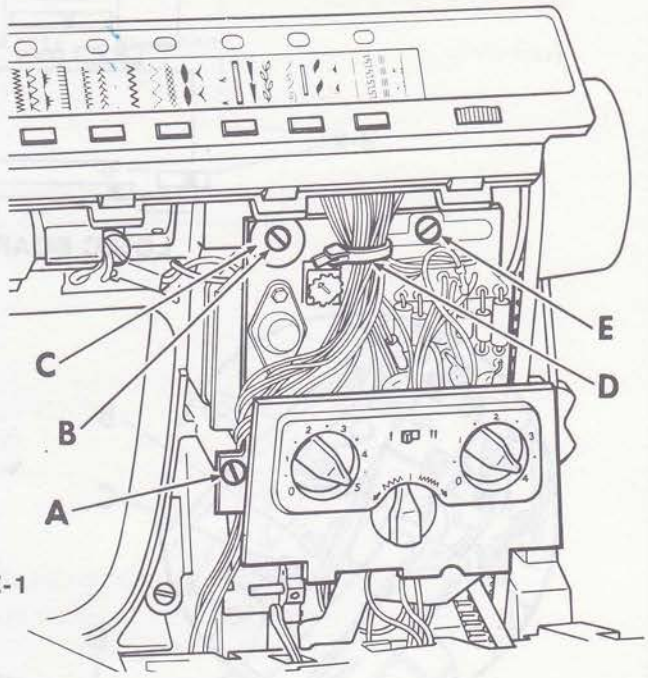
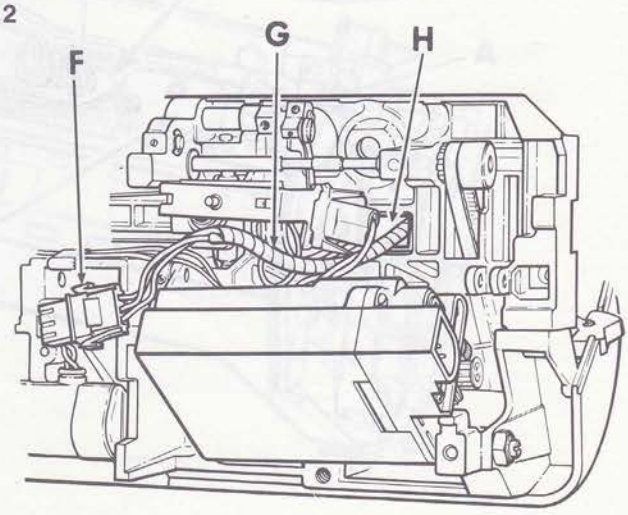


OVERRIDE BOARD ASSEMBLY





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OVERRIDE CONTROL P.C. BOARD AND PANEL ASSEMBLY

Removal:

1. Remove arm top cover, front cover and bottom cover.
2. Remove servo board assembly.
3. Remove plugs J-5, J-8, J-16, and J-7 from logic board assembly, and plug J-6 from the servo board assembly.
4. Clip tie wrap **D** containing wire harnesses.
5. Remove transformer secondary leads from terminals J-1, J-2 and J-3 on override board assembly.
6. Lay machine on its back on a soft cloth.
7. Remove motor but do not disconnect motor Mate-N-Lock connector.
8. Remove override board assembly mounting screw **B** with washer **C** and screws **A** and **E.**
9. Ease override board harnesses out from between linear bight motor and button carrier assembly.
10. Carefully lift override board assembly and ease transformer secondary wires out of access hole in the assembly.
11. Disconnect Mate-N-Lock connector **F** connecting filter capacitors to override board assembly and bring harness **G** with connector up through hole **H.**
12. Remove override board assembly from machine.

Replacement:

1. Replacement is the same as removal in reverse order.

NOTE: Since tie wrap **D** must be cut in order to remove, it will be necessary to replace with a new piece.

TRANSFORMER AND TRANSFORMER HOUSING

Removal:

1. Remove arm top cover and front cover.
2. Remove servo board assembly.
3. Remove plugs J-5, J-8, J-16, and J-7 from logic board assembly.
4. Ease override board harnesses out from between linear bight motor and button carrier assembly.
5. Remove override board assembly mounting screw **B** with washer and screws **A** and **C.**
6. Bring left edge of override board assembly forward to gain access to transformer cover **K.**
7. Remove transformer cover by pressing down on cover **K** while lifting up on transformer housing **F** until tab **J** clears slot **G** and cover can be removed.
8. With a needle nose pliers, remove transformer secondary leads from terminals **N, O,** and **P.**
9. Lay override board assembly carefully on bed of machine.
10. Remove transformer primary leads from terminals **L** and **M.**
11. Remove transformer housing mounting screws **H** and **I.**
12. Remove transformer with transformer housing.
13. Remove transformer retaining pins **D** and **E.**
14. Remove transformer from transformer housing.

Replacement:

1. Replacement is the same as removal in reverse order.

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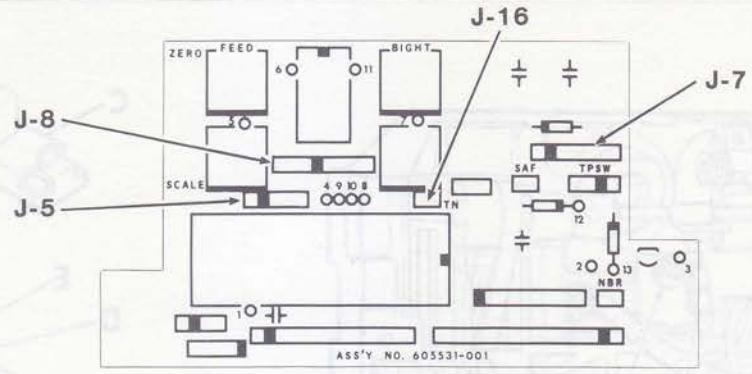
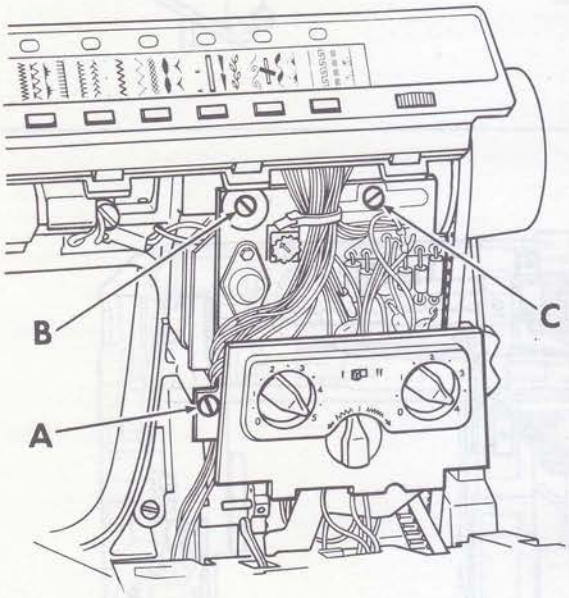
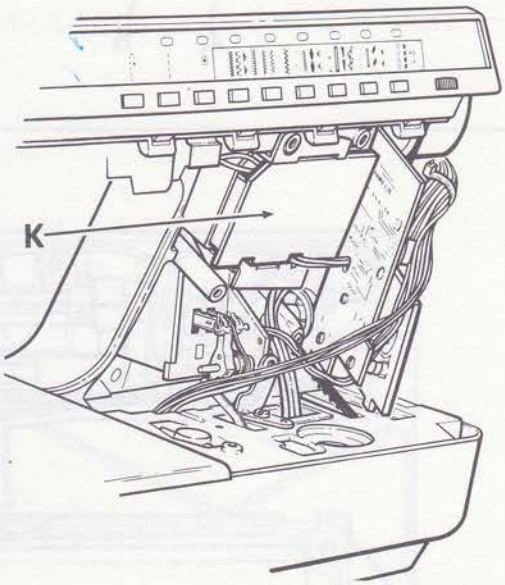
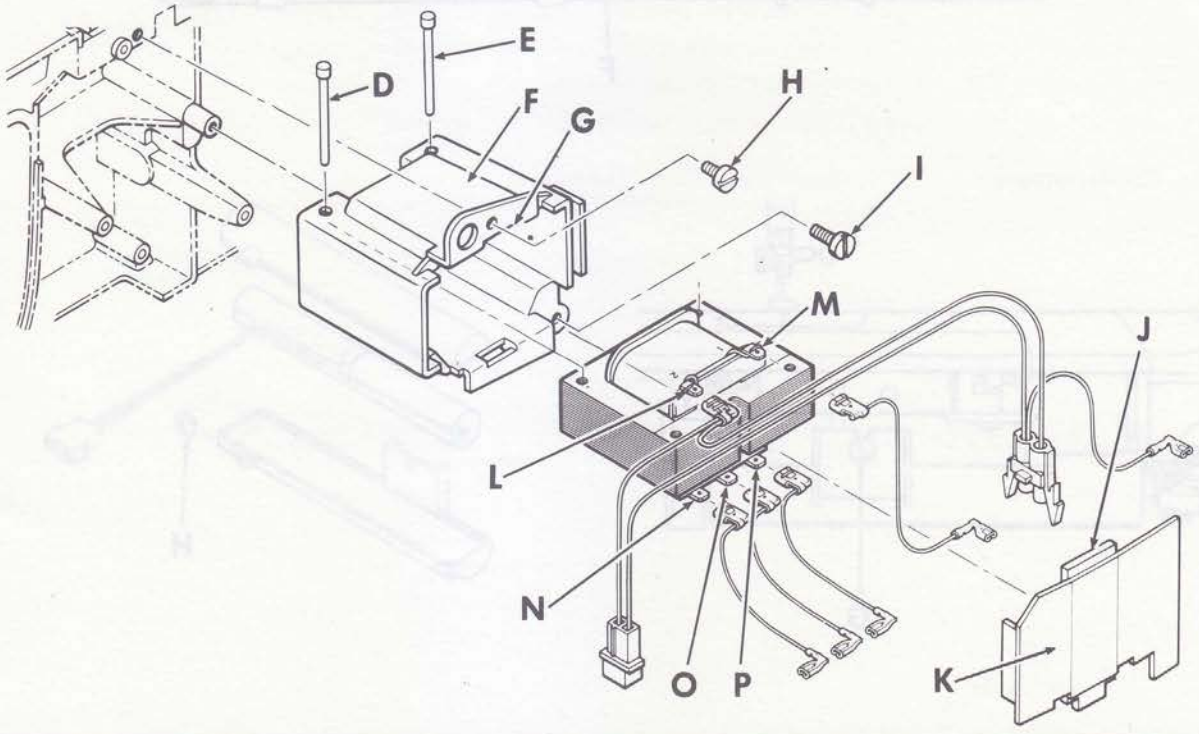
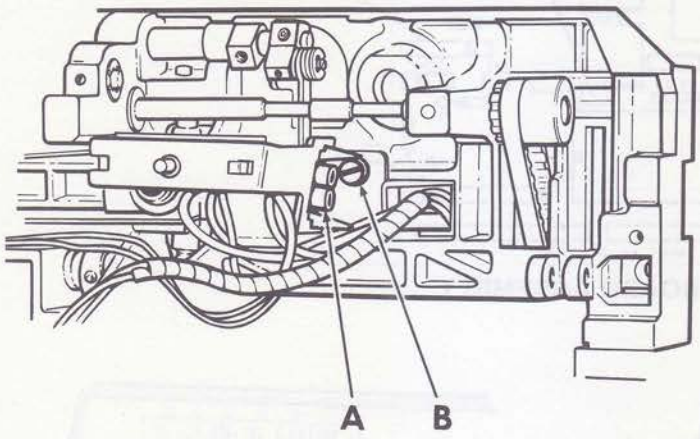


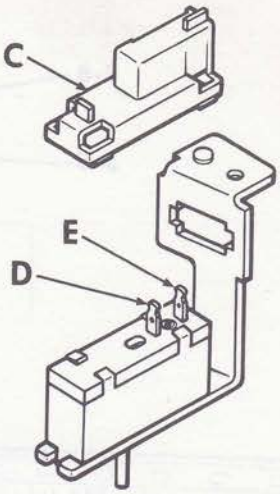
LOGIC BOARD ASSEMBLY

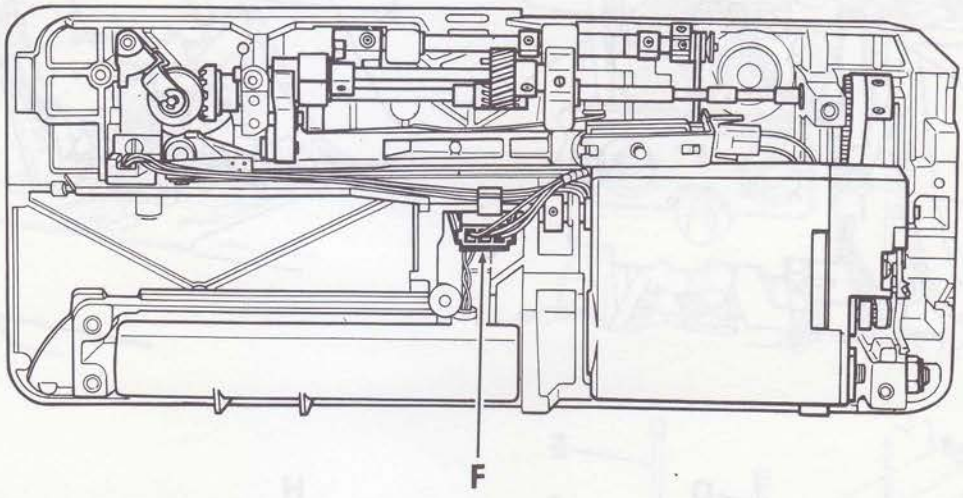


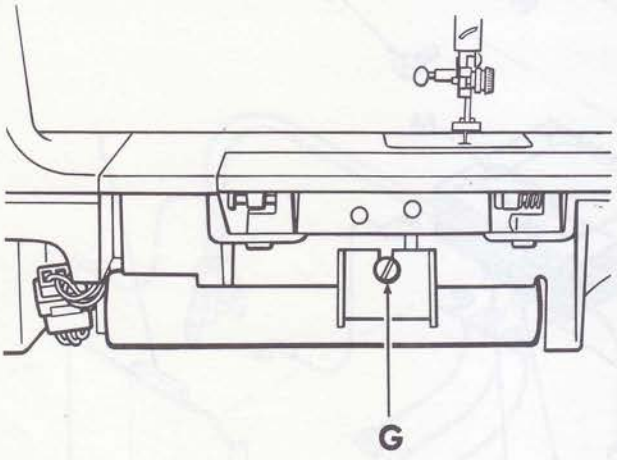


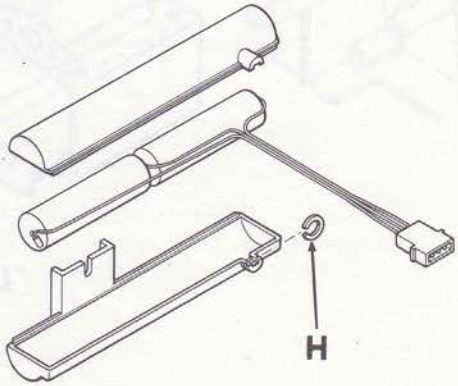












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CIRCUIT BREAKER

Removal:

1. Remove bottom cover.
2. Remove motor.
3. Slide Mate-N-Lock connector **A** out of circuit breaker bracket to gain access to mounting screw **B.**
4. Remove screw **B.**
5. Remove circuit breaker cover **C.**
6. Remove circuit breaker leads from terminals **D** and **E.**

Replacement:

1. Replacement is the same as removal in reverse order.

FILTER CAPACITORS

Removal:

1. Remove bottom cover.
2. Remove capacitor harness Mate-N-Lock connector **F** from recess in casting and disconnect.
3. Remove capacitor housing mounting screw **G.**
4. Remove clamping ring **H.**
5. Remove sealing tape from ends of housing and remove capacitors.

Replacement:

1. Replacement is the same as removal in reverse order.

LINEAR FEED MOTOR

Removal:

1. Remove arm top cover, front cover and bottom cover.
2. Remove linear servo board assembly.
3. Remove plugs J-5, J-8, J-16, J-7, and J-14 from logic board assembly.
4. Clip tie wrap **D** containing wire harnesses.
5. Ease override board harnesses out from between linear bight motor and button carrier assembly.
6. Remove override board assembly mounting screw **B** with washer and screws **A** and **C.**
7. Bring left edge of override board assembly forward to gain access to transformer cover **E.**
8. Remove transformer cover by pressing down on cover **E** while lifting up on transformer housing **I** until tab **M** clears slot **J** and cover can be removed.
9. With a needle nose pliers, remove transformer secondary leads **F, G** and **H.**
10. Lay override board assembly carefully on bed of machine.
11. Remove transformer mounting screws **K** and **L.**
12. Remove transformer housing with transformer and lay carefully on bed of machine.
13. Remove connecting link retaining clip **O,** washer **N** and retaining clip **Q.**
14. Remove connecting link **P.**
15. Remove linear motor bracket mounting screws **R, S** and **T.**
16. Remove linear motor.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Verify zero location of linear feed motor bobbin.
3. Check Alpha feed zero.
4. Perform bind test for feed mechanism.
5. Replace bottom cover, front cover and arm top cover.

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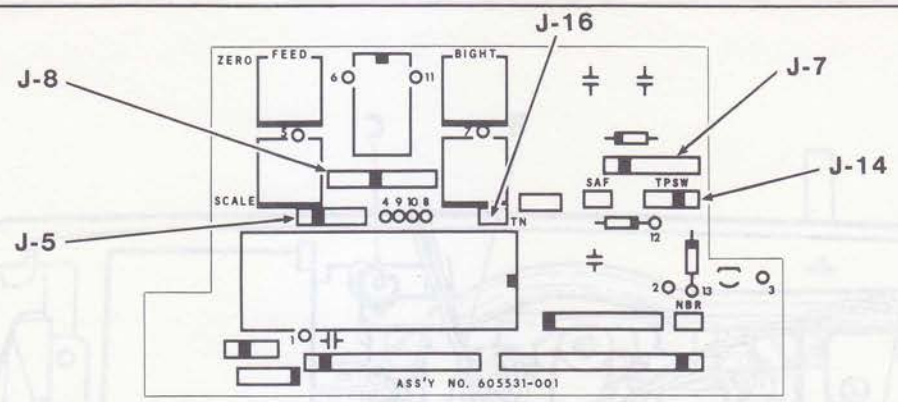
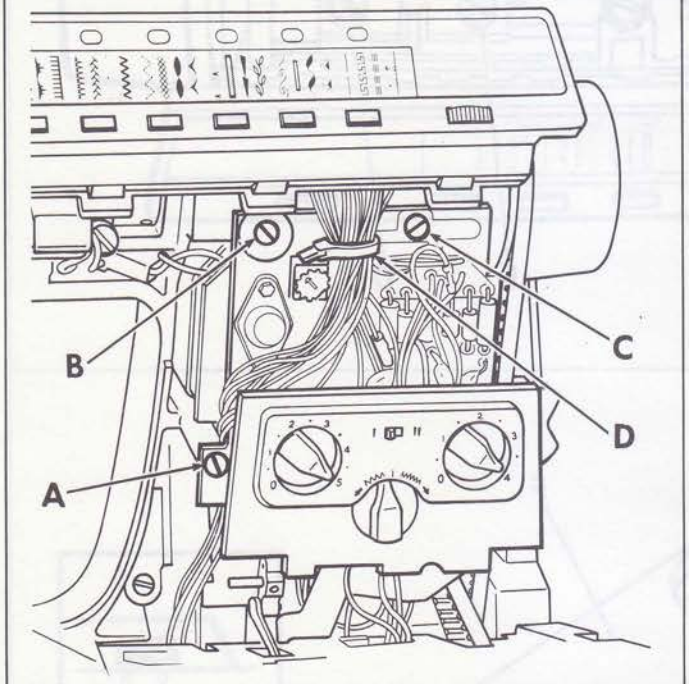
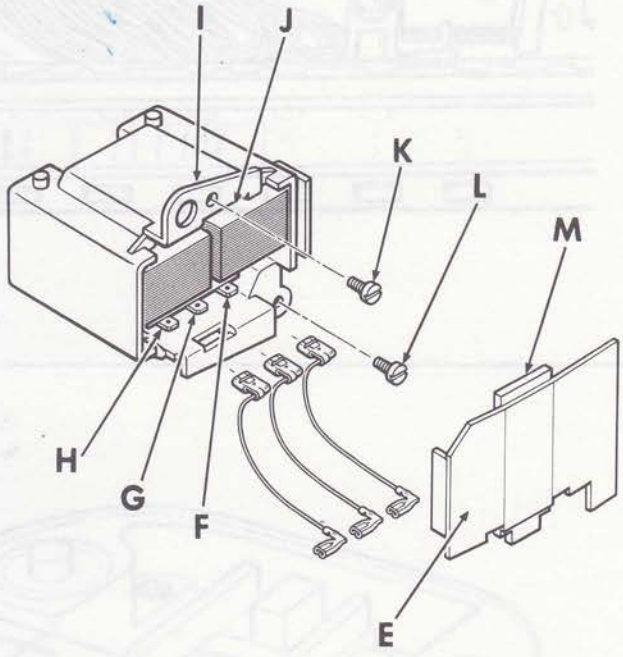
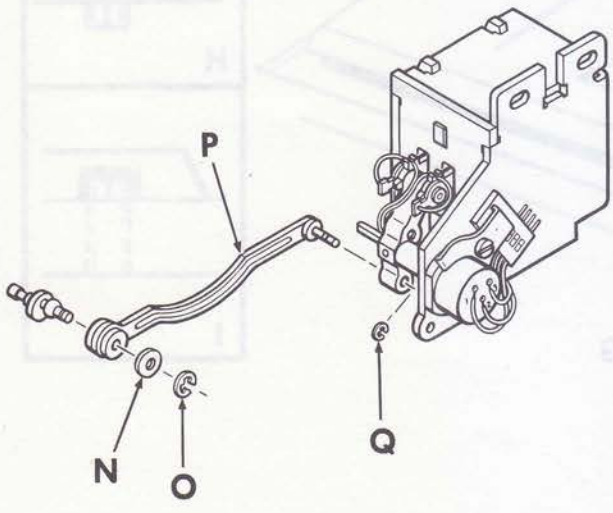
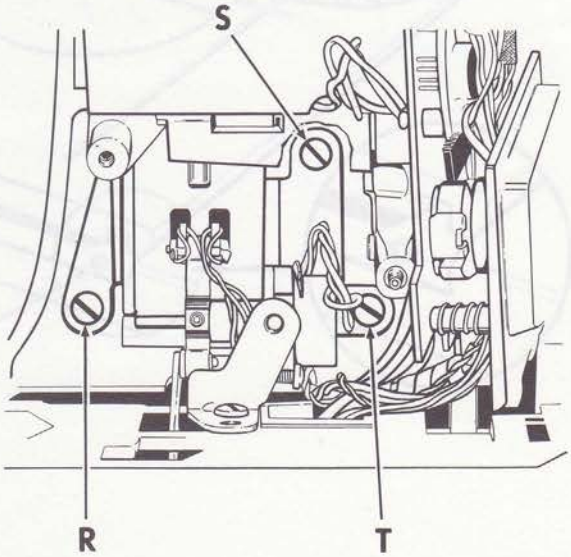


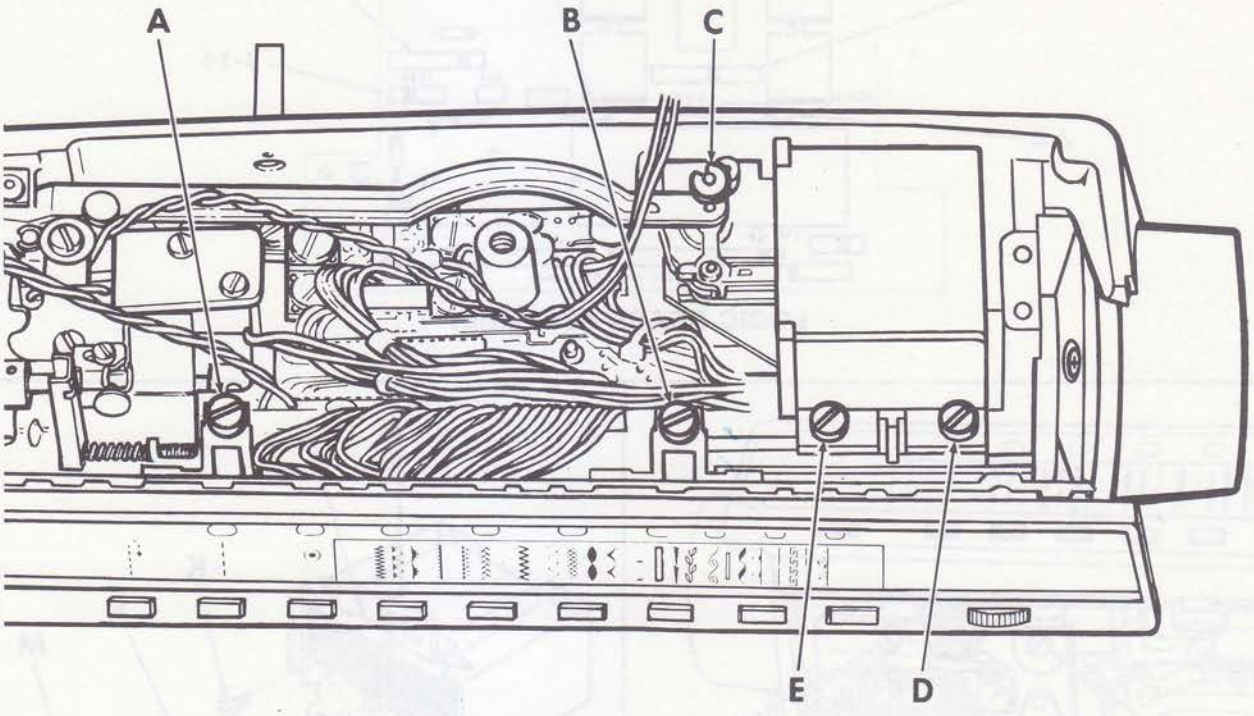
LOGIC BOARD ASSEMBLY

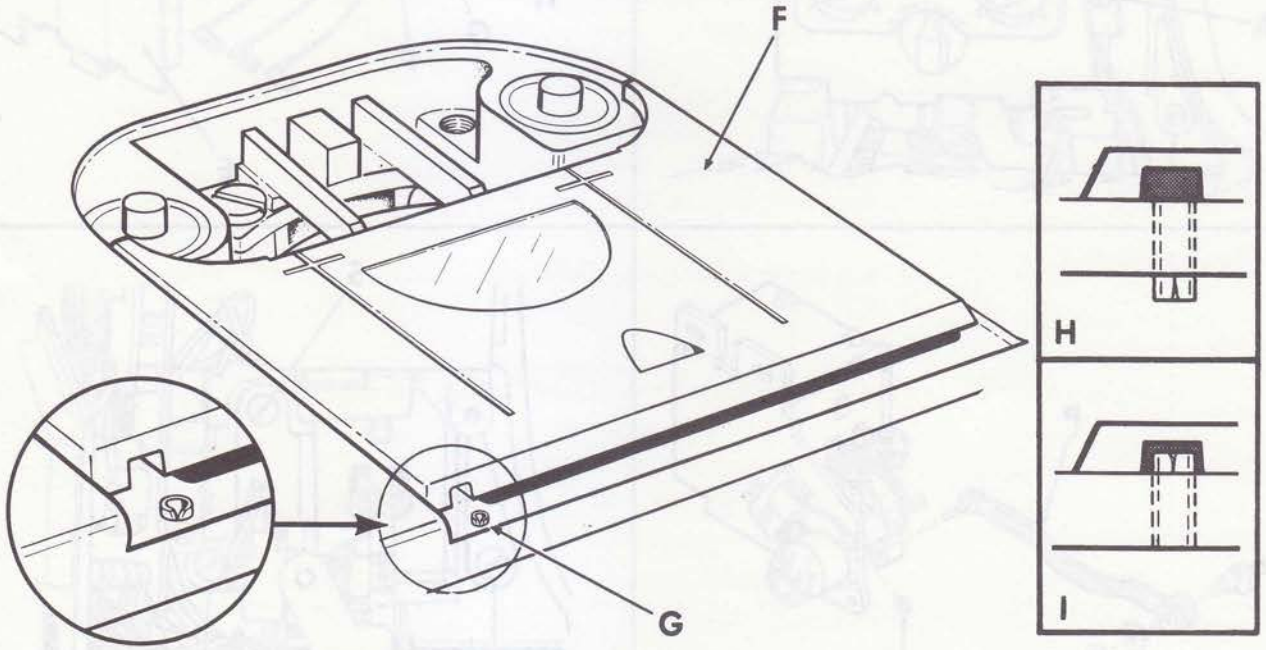












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LINEAR BIGHT MOTOR

Removal:

1. Remove arm top cover.
2. Remove linear servo board assembly.
3. Remove needle bar driving arm spacer **C** and carefully lift needle bar driving arm off linear bight motor link.
4. Loosen button carrier assembly mounting screws **A** and **B** so assembly can be slightly shifted forward.
5. Remove linear bight motor mounting screws **D** and **E.**
6. Tilt upper right corner of motor up and lift motor assembly straight out of machine.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Verify zero location of linear bight motor bobbin.
3. Check for correct positioning of needle bar driving arm positioning solenoid lever.
4. Check needle location.
5. Perform bind test for bight mechanism.
6. Replace arm top cover.

SLIDE PLATE

Removal:

1. Remove bottom cover.
2. Remove needle plate.
3. Move slide plate **F** back toward feed dog.
4. Tap pin **G** at left front of bed until it is flush with bed of machine, see illustration **H,** to allow disengagement of slide plate.
5. Pull out slide plate toward front of machine.

Replacement:

1. Insert slide plate **F** and push it back toward feed dog.
2. Tap pin **G** up from bottom of machine bed until it is flush with underside of bed, see illustration **I.**
3. Pull slide plate back and replace needle plate.
4. Replace bottom cover.

BOBBIN WINDER ACTUATING LEVER AND DRIVER ASSEMBLIES

Removal:

1. Remove bottom cover.
2. Remove slide plate.
3. Loosen actuating lever cam set screws **P.**
4. Remove actuating lever cam **O.**
5. Remove bobbin winder driver assembly **N** by drawing out of hook shaft.
6. Remove bobbin winder actuating lever assembly **Q** from top of bed.

Replacement:

1. Replacement is the same as removal in reverse order.
2. Adjust bobbin winder actuating lever radial, height settings and bobbin driver height setting as outlined in Bobbin Case Thread Clearances.
3. Replace slide plate and bottom cover.

HOOK

Removal:

1. Remove bottom cover.
2. Remove needle, presser foot, needle plate, slide plate, position plate **H** (see Bobbin Case Thread Clearance adjustment for removal procedure), bobbin **E,** bobbin case **F,** and feed dog **D.**
3. Turn position finger slotted screw **C** (left hand thread) CLOCKWISE to unscrew. Remove screw **C** and position finger **B.**
4. Remove actuating lever **A** and driver assembly **N.**
5. Using a grease pencil, mark bevel gears **K** located below hook shaft **I.** Mark two teeth on one gear and one tooth on other gear where teeth mesh.
6. Loosen set screw **M** in hook shaft gear **L** and remove hook **G.**

Replacement:

1. Replace hook **G** and turn it until flat on hook shaft **I** is aligned with set screw in gear **L.**
2. Align gears **K** using grease pencil marks on teeth to assure proper mesh.
3. Hold hook down and bring hook shaft gear **L** to finger tight mesh with hook driving gear **J.** Tighten set screw **M** in hook shaft gear.
4. Run machine and observe inside diameter of hook for runout. There should be no observable hook wobbling; this impression is given when the hook shaft is not perpendicular to the hook face. If runout is observed, replace the hook by a new one.
5. Check for correct hook timing. If hook timing is incorrect, retime hook and feed.
6. If gears are noisy, recheck gear mesh.
7. Replace actuating lever **A** and driver assembly **N.**
8. Replace position finger **B,** turn slotted screw **C** COUNTERCLOCKWISE to tighten. Tighten screw **C** to pinch tightness.
9. Replace feed dog **D,** bobbin case **F,** bobbin **E** and position plate **H.**
10. Adjust the thread clearance on the bobbin case.
11. Adjust actuating lever.
12. Recheck bobbin driver height.
13. Replace needle and slide plates.

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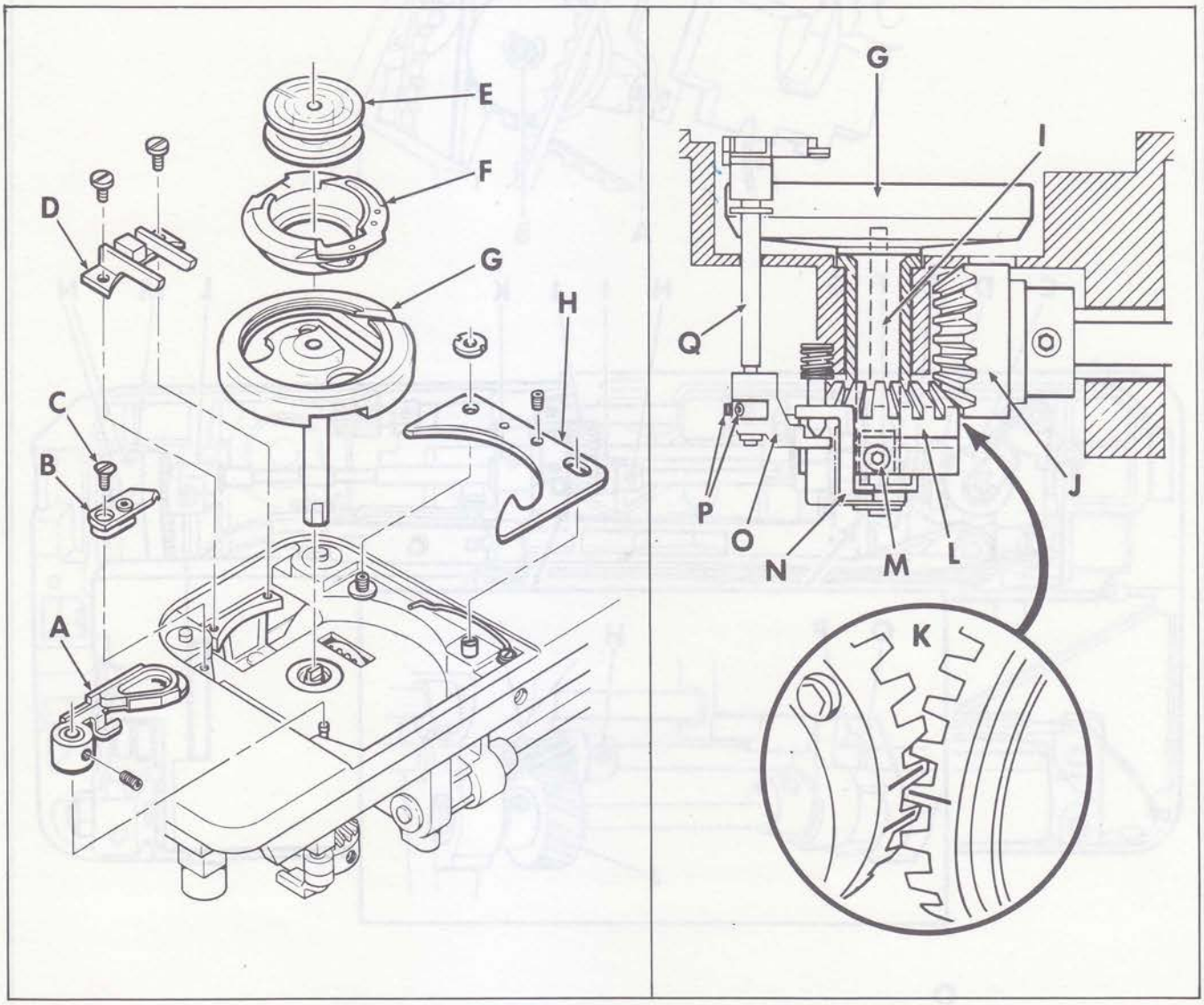
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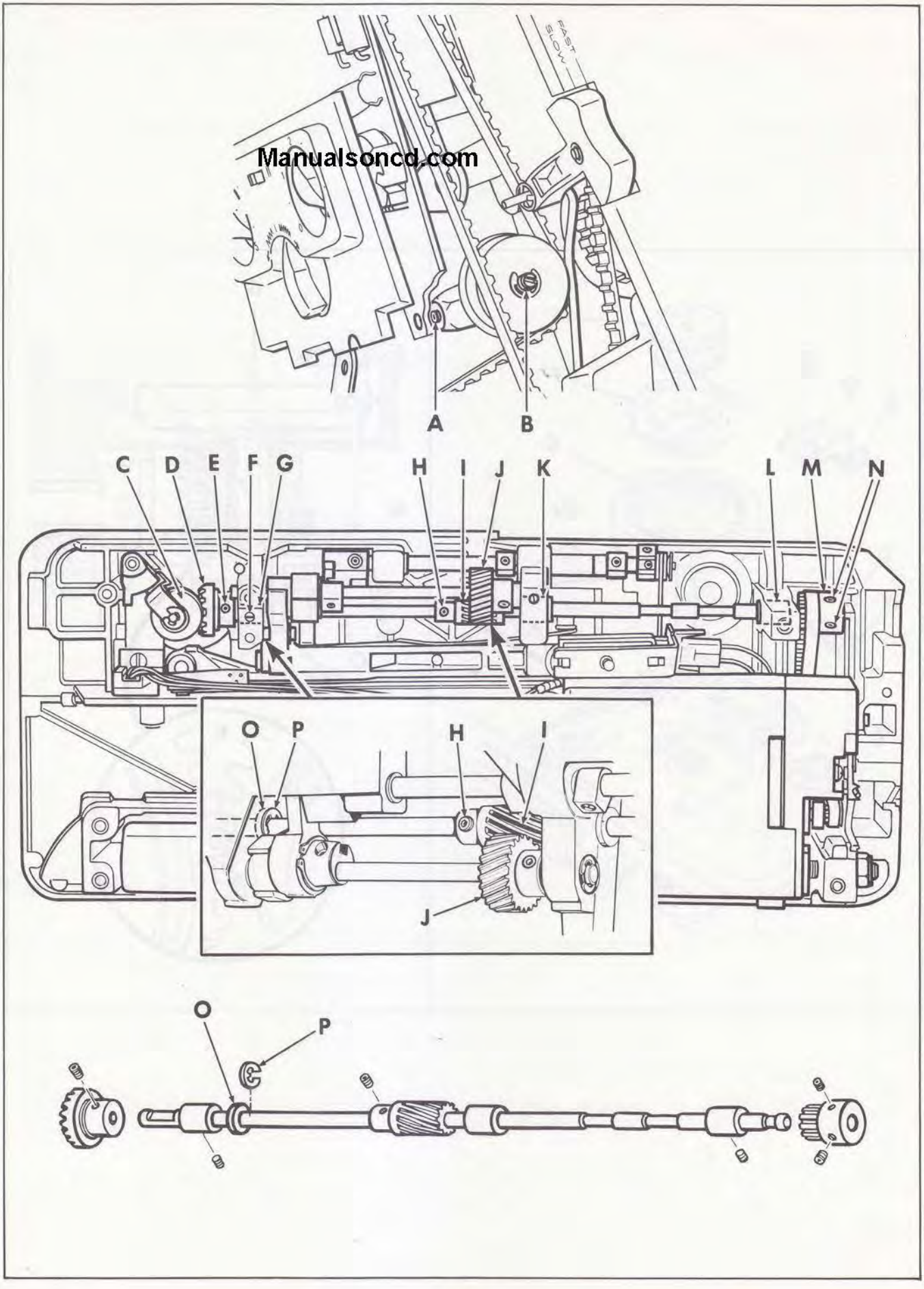

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HOOK DRIVE SHAFT - HOOK DRIVE GEAR - FEED DRIVE GEAR

Removal:

1. Remove needle.
2. Remove front cover and bottom cover.
3. Loosen idler pulley set screw **A** and turn idler eccentric **B** for maximum looseness of timing belt.
4. Loosen two set screws **N** in timing cog pulley.
5. Loosen set screw **E** in hook drive gear and set screw **H** in feed drive gear being sure both are clear of recess in shaft.
6. **Note:** If hook drive gear only is to be removed, slide hook shaft to the right until it is clear of drive gear **D.** It may be necessary to rotate feed drive shaft by means of gear **J** to provide clearance for retaining clip **P.** Loosen bushing set screw **F** and slide bushing to the right. Remove drive gear **D.**
7. Continue to withdraw hook drive shaft until retaining clip **P** is accessible.
8. Remove retaining clip **P.**
9. Remove feed drive gear **I.**
10. Remove hook drive shaft.

Replacement:

1. Insert hook drive gear end of shaft through timing cog pulley **M** and bushing **L.** Be sure timing cog pulley is properly located on the hook drive shaft with the cogs of the pulley toward the casting. Also, be sure timing belt is properly located on timing cog pulley.
2. Push the shaft through bushing **K** and feed drive gear **I.**
3. Replace retaining clip **P.**
4. Be sure thrust washer **O** is in place and push the shaft through bushing **G** and hook drive gear **D.**
5. Locate hook drive gear set screw **E** on flat of shaft.
6. With retaining clip **P** against bushing **G,** locate hook drive gear **D** against bushing **G** with light finger pressure and tighten set screw **E.**
7. Loosen bushing set screw **F** and move hook drive gear **D** lightly against hook gear **C** to obtain proper mesh.
8. Locate feed drive gear set screw **H** on flat of shaft.
9. Position the feed drive gear **I** so feed gear **J** is located midway on the feed drive gear and tighten feed drive gear set screw **H.**
10. Temporarily secure set screws **N** in the timing cog pulley.
11. Adjust timing belt tension.
12. Run the machine to check for proper gear mesh. Reset if necessary as outlined in step 7.
13. Replace needle and retime hook and feed time.
14. Replace bottom cover and front cover.

FEED DRIVE SHAFT

Removal:

1. Remove bottom cover.
2. Loosen two set screws **D** in feed timing eccentric.
3. Loosen set screw **F** in feed gear **E.**
4. Loosen set screw **H** holding rear feed drive shaft bushing **G.**
5. Slide bushing **G** to right out of boss in casting.
6. Tilt right end of feed drive shaft up and remove with retaining clip **I** by sliding out to right.

Replacement:

1. Thread bushing **G** on feed drive shaft with retaining clip **I.**
2. Thread feed drive shaft through bushing hole in boss of casting.
3. Thread feed drive shaft through feed gear **E,** feed bar connecting assembly **B** and bushing **A.**
4. Align bushing **G** in boss of casting and temporarily secure set screw **H.**
5. With retaining clip **I** against bushing **G,** locate feed gear **E** against bushing **G** with light finger pressure and tighten set screw **F.**
6. Retime feed.
7. Loosen set screw **H.** Move bushing **G** with shaft left or right to attain proper alignment between feed drive connecting link **B** and feed drive eccentric **C** to prevent binding.
8. Tighten set screw **H.**
9. Perform bind test for feed mechanism.
10. Replace bottom cover.

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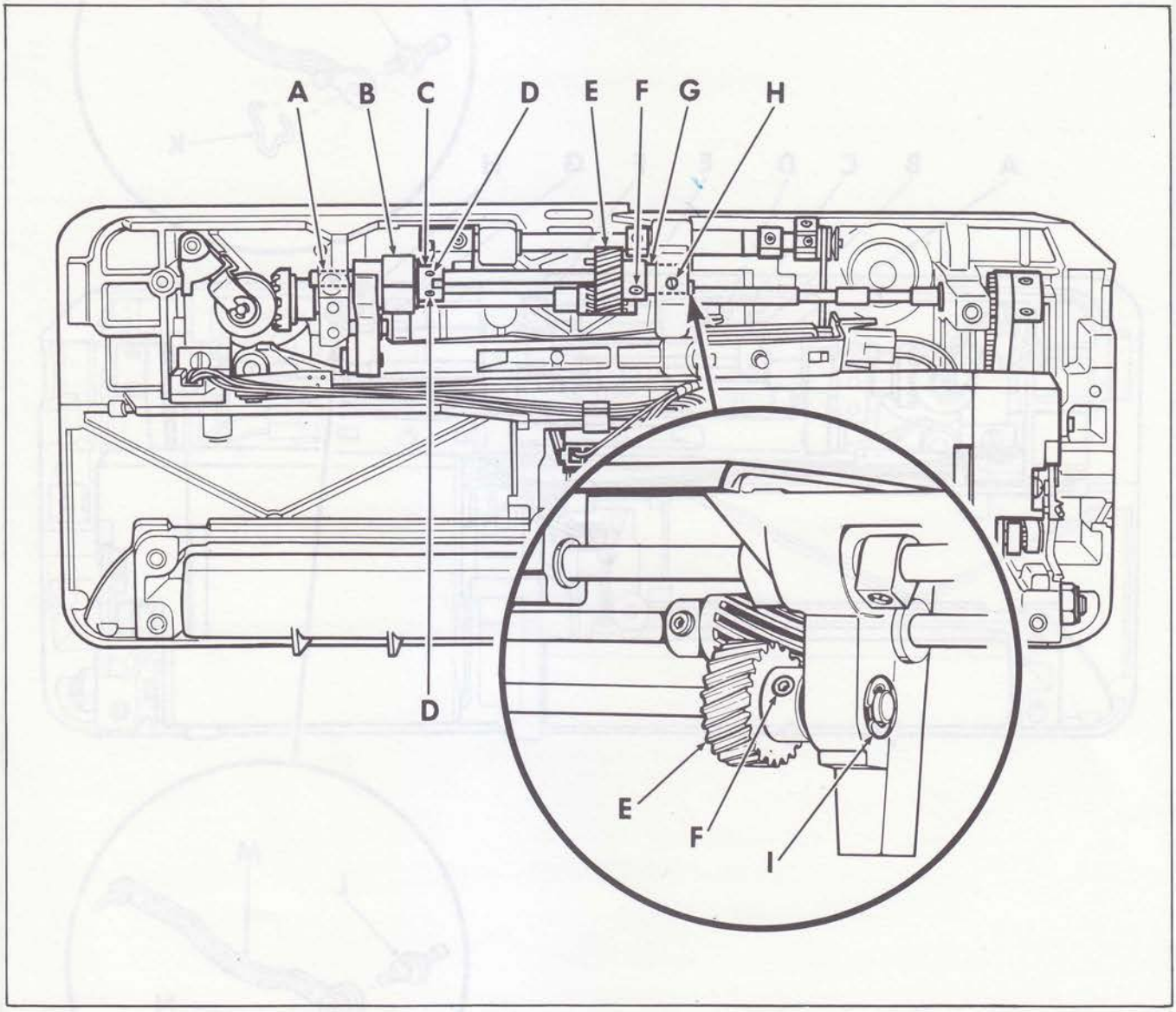
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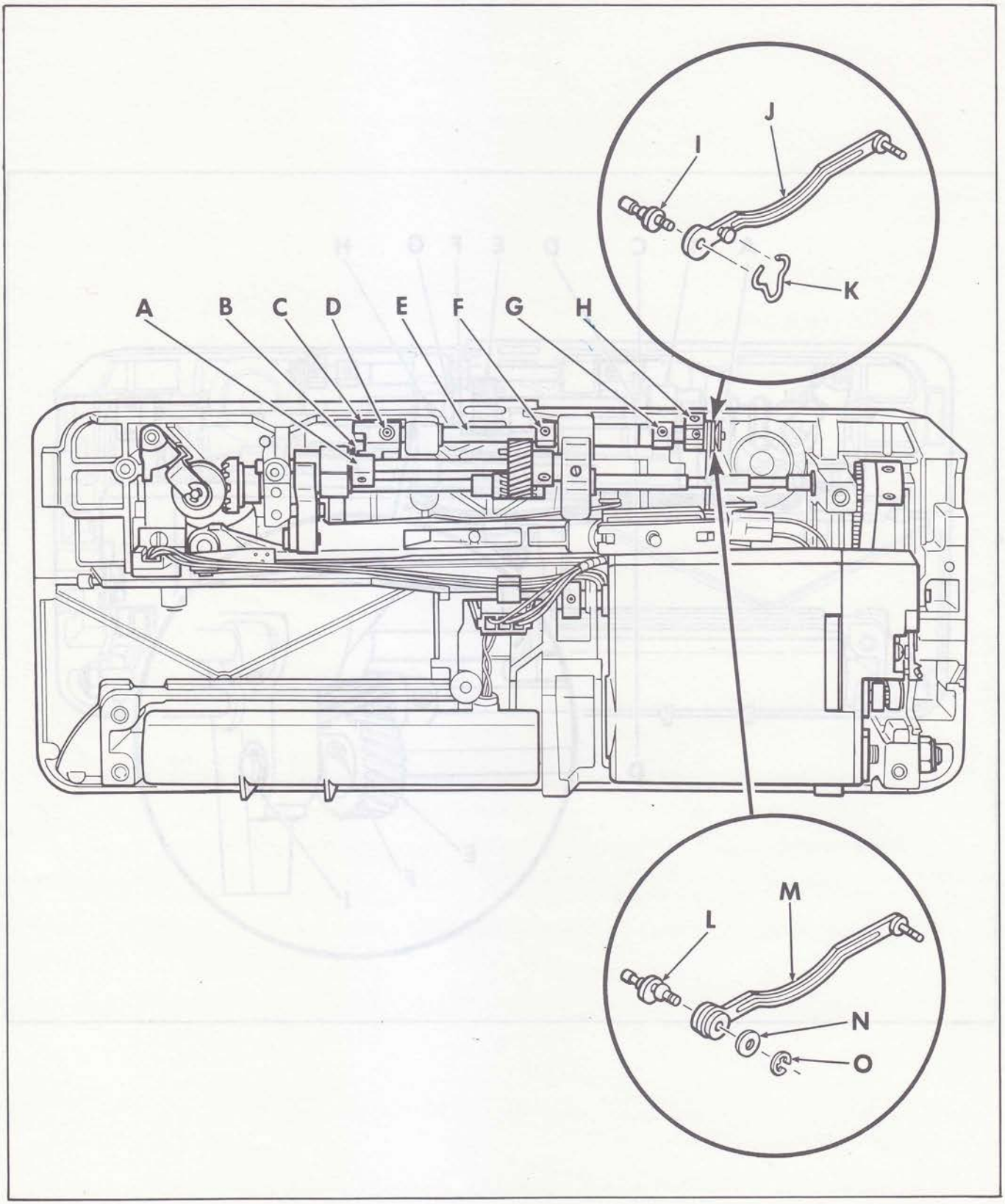

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FEED REGULATOR SHAFT & FEED REGULATOR AND BLOCK

Removal:

1. Remove bottom cover.

Earlier Production:

Remove connecting link retaining spring **K** and carefully remove connecting link **J** from eccentric stud **I.**

Later Production:

Remove retaining clip **O** and washer **N.** Rotate feed regulator shaft **E** as far toward the front of the machine as possible and carefully remove connecting link **M** from eccentric ball stud **L.**

2. Loosen set screw **H** in regulator crank and remove with eccentric stud from regulator shaft.
3. Loosen set screws **D, F** and **G** until they are clear of recesses in feed regulator shaft.
4. Slide feed reglator shaft **E** to the right until it is clear of the machine.
5. Position body of feed cam and eccentric **A** to a position which allows maximum clearance for removal of feed regulator.
6. Remove feed regulator **C** and slide block **B.**

Replacement:

1. Replacement is the same as removal in reverse order.
2. Check Alpha feed zero.
3. Perform bind test for feed mechanism.
4. Replace bottom cover.

FEED BAR CONNECTING LINK

Removal:

1. Remove bottom cover.
2. Remove hook and drive shaft to right until they are clear of drive connection assembly **I.**
3. Loosen set screw **C** and remove hinge stud **D** with its retaining clip in place.
4. Remove retaining clip **H.**
5. Slide ball bushing **G** off eccentric stud **A.**
6. Lift drive connection assembly **I** out of feed lifting fork **B.**
7. Rotate feed regulator shaft counterclockwise to its maximum position and remove slide block **J** from feed regulator **K.**
8. Tilt lower end of drive connection assembly **I** to right to remove it from eccentric stud **A.**
9. Lift drive connection assembly **I** up and to the left to remove it and feed bar connecting link **F** from machine. Be careful not to lose wave washer **E.**

NOTE: If necessary, feed regulator **K** may now be removed by loosening set screw **L** and sliding feed regulator off feed regulator shaft.

Replacement:

1. If feed regulator **K** has been removed, replace it on feed regulator shaft. Do not tighten set screw **L** at this time.
2. Be sure wave washer **E** is in place. Insert drive connection assembly **I** at a 45 degree angle to bring lower end of feed bar connecting link **F** over eccentric stud **A.**
3. Insert slide block **J** onto upper end of drive connection assembly, and then into slide of feed regulator **K.**
4. Replace ball bushing **G** and retaining clip **H.**
5. Locate regulator set screw **L** on flat of feed regulator shaft.
6. Locate feed regulator **K** so there is no binding or excessive play between it and slide block **J.** Tighten feed regulator set screw **L.**
7. Replace hinge stud **D** with its left end flush with left surface of boss; tighten set screw **C.**
8. Position drive connection assembly **I** into feed lifting fork **B.**
9. Replace hook drive shaft.
10. Replace feed drive shaft.
11. Re-time hook and feed as described in Adjustment Procedures under Hook and Feed Timing.
12. Check Alpha feed zero.
13. Peform bind test for feed mechanism.
14. Replace bottom cover.

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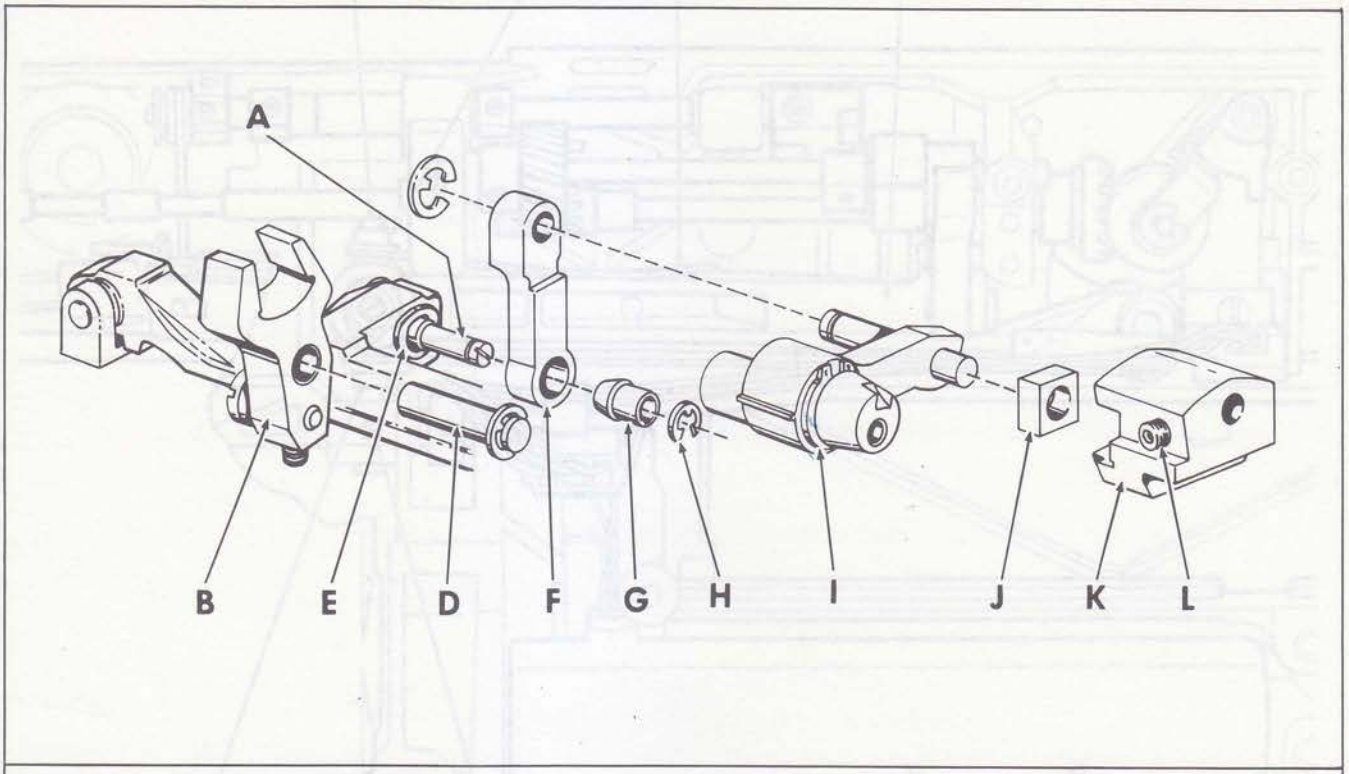
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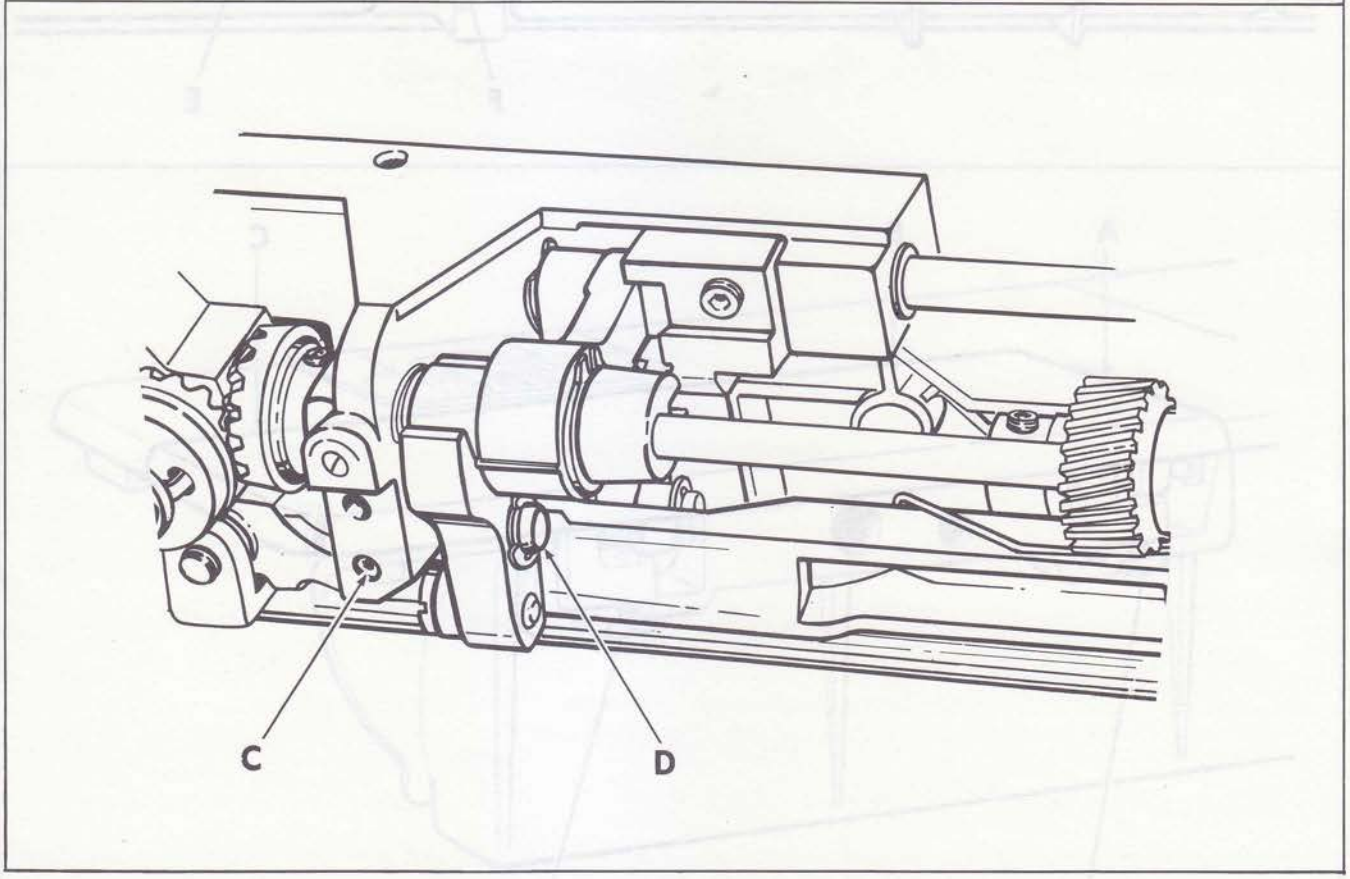
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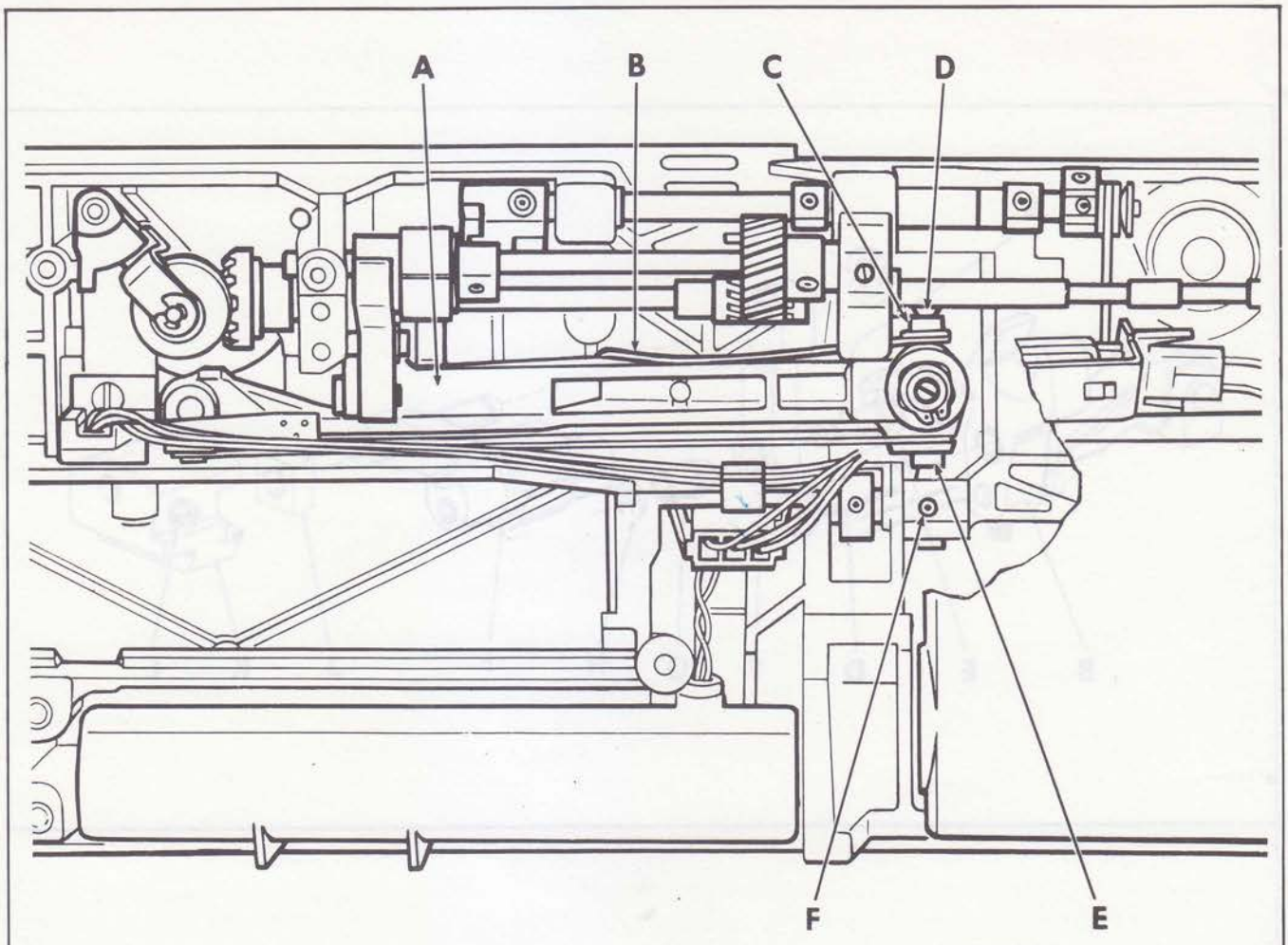

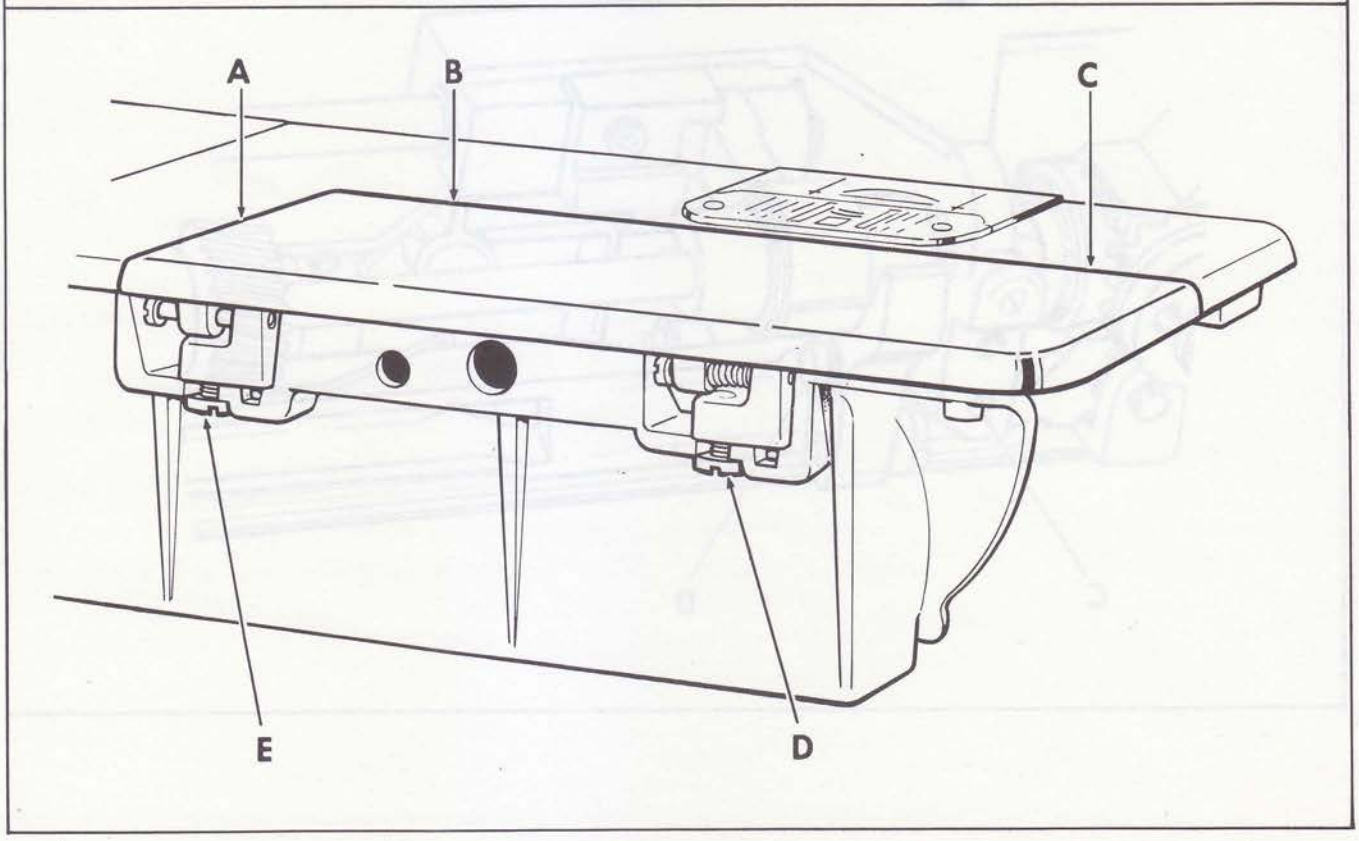

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FEED BAR

Removal:

1. Remove feed dog.
2. Remove bottom cover.
3. Remove motor.
4. Remove needle plate safety switch.
5. Remove feed bar connecting link assembly.
6. Disconnect spring **B** from feed bar.
7. Loosen set screw **F** and remove cone point bearing **E.**
8. Remove feed bar assembly **A.**

Replacement:

1. Position feed bar assembly **A** with upper feed bar pivot stud **C** seated on upper cone pointed bearing **D.** Be sure spring **B** is properly located over pivot stud **C** and that its short leg is engaged with the rib of the casting.
2. Replace the lower cone pointed bearing **E.** Make sure it is properly seated into the feed bar lower pivot stud.
3. Applying finger pressure to the lower cone point bearing **E** tighten set screw **F.**
4. Engage spring **B** over top of feed bar **A.**
5. Check for any binding or looseness of the feed bar between the cone point bearings. There must be a "perfect fit." If necessary, reset by adjusting the lower cone pointed bearing **E.**
6. Replace feed bar connecting link assembly.
7. Replace motor.
8. Replace feed dog.
9. Adjust feed mechanism as described in Adjustment Procedures under Alpha Feed.
10. Perform bind test for feed mechanism.
11. Replace bottom cover.

HINGED BED PLATE

Removal:

1. Remove bottom cover.
2. Loosen one turn, two screws **D** and **E** holding plate hinges to bed casting.
3. Remove hinged bed plate assembly by pulling it away from the machine bed.

Replacement:

1. Slide hinge bracket screws **D** and **E** into their corresponding grooves in the bed of the machine. Tighten both screws pinch tight.
2. Insert .015" thickness gauges at three points, **A, B** and **C.**
3. Adjust the plate to .015" clearance at the three points **A, B** and **C** and tighten screws **D** and **E.**
4. Remove thickness gauges and test hinged bed plate for proper latching.

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